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blue. On expoſing the liquor to the open air, it all evaporates, leaving pure water behind.

1183
How to free the colouring matter perfectly from its vitriolic taint.

As in all the operations with vitriolic acid hitherto related, ſome ſmall quantity of it paſſes into the receiver, our author ſhows how to deprive the colouring matter, of that vitriolic taint. For this purpoſe nothing more is neceſſary than to put a little chalk into the matter, and rediſtil it with a very gentle heat; the acid unites with the chalk, and the colouring matter goes over in its greateſt purity.

1184
How to prevent the eſcape of the colouring matter thro' the lute.

In order to hinder, as much as poſſible, the eſcape of the volatile colouring matter through the lute, he makes uſe of a ſmall receiver, putting into it a little diſtilled water, and placing it ſo that the greater part ſhall be immerſed in cold water during the operation. The water impregnated with this colouring matter has a peculiar but not diſagreeable ſmell, a taſte ſomewhat approaching to ſweet, and warm in the mouth, at the ſame time exciting cough.

1185
This matter neither acid nor alkaline.

When rectified as above directed, it appears to be neither acid nor alkaline; for it neither reddens paper dyed with lacmus, nor does it reſtore the colour of ſuch paper after it has been made red; but it renders turbid the ſolutions of ſoap and hepar ſulphuris. The ſame liquor mixed with fixed alkali, though it contains a ſuperabundance of colouring matter, reſtores the blue colour of paper reddened by an acid. By diſtillation to dryneſs, there goes over a part of the colouring matter which diſengages itſelf from the alkali; the reſiduum is ſoluble in water, and has all the properties of the beſt lixivium ſanguinis; but, like the true lixivium, it is decompoſed by all the acids, even by that of fixed air.

1186
Forms a kind of ammoniacal ſalt with volatile alkali.

With cauſtic volatile alkali it forms a kind of ammoniacal ſalt; which, however, always ſmells volatile, though the colouring matter be in ever ſo great proportion. By diſtillation the whole inſtantly riſes, and nothing but pure water is left in the retort.

1187
Diſſolves magneſia alba.

Magneſia precipitated from Epſom ſalt by cauſtic volatile alkali, was diſſolved in the colouring matter by allowing them to ſtand together for ſeveral days in a warm cloſe bottle. On expoſure to the open air, the magneſia ſeparated from it by its ſuperior attraction for aerial acid, and formed on the ſurface of the water a pellicle like that of cream of tartar. This ſolution was likewiſe decompoſed by alkalies and lime-water.

1188
Very little terra ponderoſa.

The colouring matter diſſolves but a very ſmall quantity of terra ponderoſa, which may be afterwards precipitated by vitriolic and even by aerial acid.

1189
Diſſolves lime, but not clay.

Pure clay, or the baſis of alum, is not attacked by it. Lime is diſſolved in a certain quantity. The ſuperabundant portion ſhould be ſeparated by filtration; and as the liquor contains, beſides the combined lime, the portion which water itſelf is able to take up, in order to free it from this, preciſely the ſame quantity of water impregnated with aerial acid is to be added as is requiſite for precipitating an equal quantity of lime-water. The colouring matter, thus ſaturated with lime, is to be filtered again, and then to be preſerved in a well cloſed bottle to prevent the acceſs of fixed air. This ſolution is decompoſed by all the acids, and by the pure or cauſtic alkalies. By diſtillation the colouring matter riſes, and nothing but pure lime is left in the retort.—This ſolution of lime appears to our author to be ſo perfectly ſaturated, that he employed it in preference to any other in the experiments he made on metals, and which we are now about to relate.

1190
The ſolution of lime the moſt proper for experiments on metals.

1191
Silver, quickſilver, and iron precipitated by the colouring matter.

From the trials made by Mr Scheele, it appears that the colouring matter has no effect upon any metal or metallic ſolution, excepting thoſe of ſilver and quickſilver in nitrous acid, and that of iron in fixed air. The firſt is precipitated in a white powder; the ſecond in a black one; and the third aſſumes a ſea-green colour, which afterwards turns to blue.

1192
Its effects on metallic calces;

With metallic calces it produces the following phenomena. 1. Gold precipitated by aerated alkali becomes white. 2. The fixed air is diſengaged from a precipitate of ſilver with a ſlight effervescence. 3. Calx of mercury is diſſolved, and yields cryſtals by gentle evaporation. 4. The calx of copper precipitated by aerated alkali effervesces, and aſſumes a faint citron colour. 5. Calx of iron precipitated from its ſolution in the vitriolic acid by the ſame alkali, effervesces, and aſſumes a dark blue colour. 6. Precipitated cobalt ſhows ſome ſigns of effervescence, and changes into a yellowiſh brown colour. The other calces are not acted upon.

1193
On metallic ſolutions.

The precipitating liquor abovementioned, poured into metallic ſolutions, produces the following appearances by means of double elective attraction. 1. Gold is precipitated of a white colour, but by adding a ſuperabundant quantity of the precipitating liquor the calx is rediſſolved. The ſecond ſolution is colourleſs as water. 2. Silver is precipitated in form of a white ſubſtance of the conſiſtence of cheeſe; by adding more of the liquor the precipitate is rediſſolved, and the ſolution is not decompoſed either by ſal-ammoniac or marine acid. 3. Corroſive ſublimate apparently undergoes no change, though it is in reality decompounded; the calx being diſſolved in the colouring matter. Mercury diſſolved in the nitrous acid without heat, is precipitated in form of a black powder. 4. The ſolutions of tin and biſmuth are precipitated, but the calx is not acted upon by the colouring matter. 5. The ſame effects are produced on the ſolution of butter of antimony, as well as on that of well dephlogiſticated calx of iron. 6. Blue vitriol is precipitated of a yellow citron colour: if more of the precipitating liquor be added, the precipitate is rediſſolved into a colourleſs liquor and a colourleſs ſolution of the ſame calx is likewiſe obtained by volatile alkali. On adding more of the ſolution of blue vitriol, the ſolution likewiſe diſappears, and the liquor aſſumes a green colour. Acids diſſolve a portion of this precipitate, and the remainder is white. The muriatic acid diſſolves the precipitate completely, but lets it fall again on the addition of water. 7. The ſolution of white vitriol yields a white precipitate, which is not rediſſolved by addition of the precipitating liquor, but is ſoluble in acids. Theſe ſolutions ſmell like the colouring matter, which may be ſeparated from them by diſtillation. 8. Green vitriol is precipitated firſt of a yellowiſh brown colour, which ſoon changes to green, and then becomes blue on the ſurface. Some hours afterwards the precipitate ſubſides to the bottom of the veſſels, and then the whole mixture turns blue; but on adding any acid the precipitate becomes inſtantly blue. If a very ſmall quantity of green vitriol be put into the precipitating liquor, the precipitate is entirely diſſolved, and the whole aſſumes a yellow colour. 7. Solution of cobalt lets fall a browniſh yellow precipitate, which is not diſſolved by adding more of the precipitating liquor, neither is it ſoluble in acids. By diſtillation the colouring matter goes over into the receiver.

1194 Inveſtigation of the conſtituent part of the colouring matter.

Laſtly, our author undertook an inveſtigation of the conſtituent parts of the colouring matter itſelf; and in this he ſucceeded in ſuch a manner as muſt do honour to his memory, at the ſame time that it promiſes to be a real and laſting improvement to ſcience, by ſhowing a method of preparing this valuable pigment without that nauſeous and horrid ingredient, blood, which is now uſed in great quantities for that purpoſe.—

1195 Inflammability of the colouring matter.

His firſt hint concerning this matter ſeems to have been taken from an obſervation of the air in his receiver accidentally taking fire from the neighbourhood of a candle. It burned without any exploſion, and he was able to inflame it ſeveral times ſucceſſively. Wiſhing to know whether any fixed air was contained in the colouring matter, he filled a retort half full of the liquor containing the colouring matter, and applying a receiver immediately after, gave the retort a briſk heat. As ſoon as the receiver was filled with thick vapours of the colouring matter, he diſjoined it, and, inflaming the vapour by a little burning ſulphur introduced into the cavity, found that the air which remained threw down a precipitate from lime-water.

1196 Aerial acid and phlogiſton ſuppoſed to exiſt in it.

“Hence (ſays he) it may be concluded, that the aerial acid (A) and phlogiſton exiſt in this colouring matter.”

It has been aſſerted by ſeveral chemiſts, that Pruſſian blue by diſtillation always yields volatile alkali.—

1197 Pruſſian blue yields volatile alkali by diſtillation.

To determine this, Mr Scheele prepared ſome exceedingly pure from the precipitating liquor abovementioned and green vitriol; diſtilling it afterwards in a glaſs retort, to which he adapted a receiver containing a little diſtilled water. The operation was continued till the retort became red-hot. In the receiver was found the colouring matter and volatile alkali, but no oil; the air in the receiver was impregnated with aerial acid, and the ſame colouring matter; the reſiduum was very black, and obeyed the magnet.

1198 Appearances on diſtilling other precipitates thrown down by Pruſſian alkali.

On ſubſtituting, inſtead of the Pruſſian blue, the precipitates of other metallic ſubſtances precipitated by the Pruſſian alkali, the reſults were: 1. The yellowiſh brown precipitate of cobalt yielded the very ſame products with Pruſſian blue itſelf; the reſiduum in the retort was black. 2. The yellow precipitate of copper took fire, and emitted, from time to time, ſparks during the diſtillation. It produced little colouring matter, but a greater quantity of aerial acid and volatile alkali than had been obtained by the former precipitates. A ſublimate aroſe in the neck of the retort, but in too ſmall a quantity to make any experiment; the reſiduum was reduced copper. 3. The precipitate of zinc yielded the ſame with Pruſſian blue. 4. That of ſilver yielded likewiſe volatile alkali and fixed air, but chiefly colouring matter; a ſublimate containing ſome ſilver aroſe into the neck of the retort; the reſiduum was reduced ſilver. 5. Calx of mercury cryſtallized by means of the colouring matter, yielded ſome of that matter, but ſcarce any mark of volatile alkali. Some mercury, with a portion of the original compound, aroſe in the neck of the retort.

1199 Ingredients contained in the colouring matter.

From theſe experiments Mr Scheele concluded, that the colouring matter of Pruſſian blue was compoſed of volatile alkali and an oily matter. He was confirmed in his conjecture, by obtaining Pruſſian blue from green vitriol and ſpirit of hartſhorn recently diſtilled on the addition of muriatic acid. The ſame product was obtained by means of the volatile ſpirit drawn from ox's blood; ſo that nothing now remained, but to imitate theſe natural proceſſes by artificially combining the two ingredients together.

1200 Unſucceſsful attempts to prepare it artificially.

For this purpoſe he diſtilled a mixture of volatile ſalt and unctuous oil; a mixture of the ſame alkali with animal fat, and with oil of turpentine; a mixture of quick-lime, ſal ammoniac, and axunge, with others of a ſimilar kind; but in vain. He began therefore to conclude, that as long as the volatile alkali contained any water, it could not enter into an union ſufficiently intimate with the other principles to form the colouring matter; and finding alſo that the coal of blood, mixed with ſalt of tartar, yielded very good lixivium ſanguinis, he concluded that no oily matter was neceſſary for the ſucceſs of the experiment.

1201 True method of forming it.

Thus was our author led to make the following deciſive trials, which at once accompliſhed his purpoſe, and ſhowed the truth of the principles he had aſſumed. Three table-ſponfuls of charcoal powder were mixed with an equal quantity of alkali of tartar, and the mixture put into a crucible. A ſimilar mixture was put into another crucible, and both put into a fire, and kept red-hot for about a quarter of an hour. One of them was then taken out, and the contents thrown, while perfectly red-hot, into eight ounces of water. At the ſame time he put into the other quantity an ounce of ſal ammoniac in ſmall pieces, agitating the whole briſkly together, and taking care at the ſame time to puſh the ſal ammoniac down towards the bottom of the crucible, which he replaced in the fire. Obſerving in two minutes after, that no ammoniacal vapours aroſe, the whole maſs was thrown, when red-hot, into eight ounces of water. The former lixivium, into which no ſal ammoniac had been put, yielded no Pruſſian blue; but the latter ſhowed the ſame phenomena with the beſt lixivium ſanguinis, and produced a great quantity of blue. By mixing plumbago with the alkali inſtead of charcoal, a tolerable lixivium was obtained.

1202 Volatile alkali capable of uniting with phlogiſton and fixed alkali, ſo as to ſuſtain a great degree of heat.

“From theſe experiments (ſays Mr Scheele), it appears, that the volatile alkali is capable of uniting with the carbonaceous matter, after it has been ſubtilized by a ſtrong heat; that it thus acquires the remarkable property of combining ſo firmly with ſalt of tartar as to be able to ſuſtain the moſt violent degree of heat; and when this lixivium is diſſolved in water, there is obtained lixivium ſanguinis, as it is called.—It is now eaſy to explain what happens in the diſtillation

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(A) This reaſoning ſeems not to be ſufficiently concluſive; for late experiments have ſhown that inflammation is generally attended with the production of fixed air, which could not be proved to have an exiſtence either in the materials or common atmoſphere before.

lation of Pruſſian blue, as well as that of the other abovementioned metallic precipitates.—

1203 Appearances on diſtilling Pruſſian blue accounted for.

In the diſtillation of Pruſſian blue, for inſtance, the calx of iron attracts a portion of phlogiſton from the colouring matter. The aerial acid being thus diſengaged, muſt go over into the receiver with the volatile alkali, which is ſet free at the ſame inſtant; but as the calx of iron in the heat of this diſtillation cannot unite with more phlogiſton, a portion of the colouring matter, not decompoſed, muſt likewiſe ariſe. If the calx of iron could combine with the whole of the phlogiſton, there would come nothing over into the reciever but aerial acid and volatile alkali.

1204 Colouring matter kept from riſing by mangaueſe.

In order to prove this, I diſtilled a mixture of ſix parts of mangaueſe finely powdered, and one part of pulverized Pruſſian blue, and obtained nothing but aerated volatile alkali, without the leaſt mark of colouring matter."

1205 The colouring matter can ſeparate only mercury and ſilver from their ſolution in nitrous acid.

Mr Scheele further remarks, that this colouring matter may probably be obtained in an aerial form, though he had not been able to do ſo. It is alſo worth notice, that, excepting the ſolutions of ſilver and mercury in nitrous acid, the colouring matter of Pruſſian blue is not able to decompoſe any other by a ſingle elective attraction. Now, as we know that Pruſſian blue is not ſoluble in acids, it naturally follows, that the colouring matter has a greater affinity with iron than acids have, notwithſtanding there is no precipitation perceived when this matter is mixed with the ſolution of vitriol of iron. "It may not be eaſy (ſays Mr Scheele) to give a ſatisfactory explanation of this phenomenon."

1206 Nitre alkalized by iron.

Iron deflagrates with nitre, and renders the ſalt alkaline and cauſtic. A part of the iron is thus rendered ſoluble, along with the alkalized ſalt. A mixture of equal parts of iron filings and nitre, injected into a ſtrongly heated crucible, and, after the detonation, thrown into water, tinges the liquor of a violet or purpliſh blue colour. This ſolution, however, is not permanent. Though the liquor at firſt paſſes through a filter, without any ſeparation of the iron; yet, on ſtanding for a few hours, the metal falls to the bottom, in form of a brick-coloured powder. Volatile alkalies inſtantly precipitate the iron from this fixed alkaline ſolution.

1207 Iron filings and ſulphur take fire ſpontaneouſly.

Iron readily unites with ſulphur; and when combined with it, proves much eaſier of fuſion than by itſelf. A mixture of iron filings and ſulphur, moiſtened with water, and preſſed down cloſe, in a few hours ſwells and grows hot; and, if the quantity is large, burſts into flame.

By cementation with inflammable maters, iron imbibes a larger quantity of phlogiſton; and becomes much harder, leſs malleable, and more fuſible. It is then called *ſteel*. See METALLURGY, and STEEL.

§ 5. *LEAD.*

LEAD is a pale or livid-white metal, ſoon loſing its brightneſs in the air, and contracting a blackiſh or greyiſh aſh-colour. It is the ſofteſt and moſt flexible of all metallic bodies; but not ductile to any great degree, either in the form of wire or leaf; coming far ſhort, in this reſpect, of all other metals.

1208 Has very little tenacity.

It has alſo the leaſt tenacity of all metallic bodies; a leaden wire of $\frac{1}{10}$ of an inch diameter being capable of ſupporting only $29\frac{1}{4}$ pounds. Lead has, however, a conſiderable ſpecific gravity; loſing, when immerſed in water, between $\frac{1}{11}$ and $\frac{1}{12}$ of its weight. It is of all metals the moſt fuſible, excepting only tin and biſmuth.

1209 Sheet-lead.

The plumbers caſt thin ſheets of lead upon a table or mould, covered with a woollen, and above this with a linen, cloth, without burning or ſcorching the cloths. The melted lead is received in a wooden caſe without a bottom; which being drawn down the ſloping table by a man on each ſide, leaves a ſheet of its own width, and more or leſs thin according to the greater or leſs celerity of its deſcent. For thick plates, the table is covered over with moiſtened ſand, and the liquid metal conducted evenly over it, by a wooden ſtrike, which bears on a ledge at each ſide.

1210 Advantages of milled lead precarious.

Some have preferred, for mechanic uſes, the milled lead, or flatted ſheets, to the caſt; as being more equal, ſmooth, and ſolid. But whatever advantage of this kind the milled ſort may appear to have at firſt, they are not found to be very durable. When the lead is ſtretched between the rollers, its cavities muſt neceſſarily be enlarged. The particles of metal that may be ſqueezed into them can have no union or adheſion with the contiguous particles; and of conſequence, muſt be liable, from bending, blows, jarrs, &c. to ſtart out again, and leave the maſs ſpongy and porous.

1211 Rendered ſonorous.

Lead yields the dulleſt and weakeſt ſound of all metallic bodies. Reaumer obſerves, that it is rendered ſonorous by caſting a ſmall quantity into a ſpherical or elliptical ſegment, as in the bottom of an iron-laddle; from hence he conjectures, that the ſound of the ſonorous metals might be improved for the bells of clocks, &c. by giving them a ſimilar form.

Though this metal very ſoon loſes its luſtre, and tarniſhes in the air, it reſiſts much longer than iron or copper the combined action of air and water, before it is decompoſed or deſtroyed; and hence it is exceedingly uſeful for many purpoſes to which theſe metals can by no means be applied.

1212 Calcined.

When juſt become fluid, lead looks bright like quickſilver; but immediately contracts a variouſly coloured pellicle on the ſurface. If this is taken off, and the fire continued, a freſh pellicle will always be formed, till the metal is by degrees changed into a duſky powder or calx. The injection of a little fat, charcoal-powder, or other inflammable matter, prevents this change, and readily revives the calx into lead again. It is ſaid, that lead, recovered from its calces, proves ſomewhat harder and whiter than at firſt, as well as leſs ſubject to tarniſh in the air.

1213 Minium.

The blackiſh calx or aſhes of lead become of a very different appearance if the calcination is continued with a fire ſo moderate as not to melt them, and particularly if expoſed to flame. By this treatment it is ſaid that they become firſt yellow; then they are called *maſſicot* or *yellow lead*. This colour becomes gradually more and more intenſe, till at laſt the calx is of a deep red; and then is called *minium* or *red lead*; but it is certain, that by proper management this calx never becomes yellow, aſſuming a reddiſh colour from the beginning. Too great a heat makes it irrecoverably yellow. It can be more eaſily prepared without expoſure to the flame. The degree of heat neceſſary for converting it into minium is between 600 and 700 of Fahrenheit.

1214 Litharge.

If inſtead of keeping this calx in a continued moderate heat, it be ſuddenly fuſed, the matter then puts on a foliated appearance, changing to a dull kind of brick-colour when powdered, and is then called *litharge*. Moſt of this ſubſtance is produced by refining ſilver with lead (ſee REFINING): and is of two kinds, white and red. Theſe two are diſtinguiſhed by the names of *litharge of gold*, and *litharge of ſilver*. The moſt perfect is that called *litharge of gold*: the pale ſort contains a conſiderable proportion of lead in its metallic ſtate; and even the higheſt coloured litharge is ſeldom free from a little metallic lead, diſcoverable and ſeparable by melting the maſs in a crucible; when the lead ſubſides to the bottom.

1215 Phenomena with other metals.

Lead mingles in fuſion with all the metals except iron, with which it refuſes any degree of union as long as the lead preſerves its metallic form. On continuing the fire, the lead, ſcorifying or calcining, abſorbs the phlogiſtic principle of the iron, and conſequently promotes the calcination of that metal; both being at length reduced to calces. The fuſible calx of lead eaſily unites with the calx of iron, and both melt together into an opaque brown or blackiſh glaſs. Copper does not unite with melted lead till the fire is raiſed ſo high as to make the lead ſmoke and boil, and of a bright red heat. Pieces of copper, now thrown in, ſoon diſſolve and diſappear in the lead: the mixture, when cold, is brittle, and of a granulated texture. The union of theſe two metals is remarkably ſlight. If a mixture of copper and lead is expoſed to a fire no greater than that in which lead melts, the lead almoſt entirely runs off by itſelf; a ſeparation of which no other example is known. What little lead is retained in the pores of the copper, may be ſcorified, and melted out, by a fire conſiderably leſs than is ſufficient to fuſe copper. If any of the copper is carried off by the lead, it ſwims unmelted on the ſurface.

Gold and ſilver are both diſſolved by lead in a ſlight red heat. They are both rendered extremely brittle by the minuteſt quantity of this metal; though lead is rendered more ductile by a ſmall quantity of either of them. In cupellation, a portion of lead is retained by gold, but ſilver parts with it all. On the other hand, in its eliquation from copper, if the copper contains any of the precious metals, the ſilver will totally melt out with the lead, but the gold will not. The attraction of lead to copper, however ſlight, is greater than that of copper to iron: a mixture of copper and iron being boiled in melted lead, the copper is imbibed by the lead, and the iron thrown up to the top. Silver is in like manner imbibed from iron by lead; whilſt tin, on the contrary, is imbibed from lead by iron. If two mixtures, one of lead and tin, and another of iron and ſilver, be melted together, the reſult will be two new combinations, one of the tin with the iron at the top, the other with the lead and ſilver at the bottom: how carefully ſoever the matter be ſtirred and mixed in fuſion, the two compounds, when grown cold, are found diſtinct, ſo as to be parted with a blow.

1216 Soluble in alkalies and in oils.

This metal is ſoluble in alkaline lixivia and expreſſed oils. Plates of lead boiled in alkaline lixivia, have a ſmall part diſſolved, and a conſiderable quantity corroded: the ſolution ſtains hair black. Lead, fuſed with fixed alkaline ſalts, is in part corroded into a dark-coloured ſcoria, which partially diſſolves in water. Expreſſed oils diſſolve the calces of lead, by boiling, in ſuch large quantities as to become thick and conſiſtent: hence plaſters, cements for water-works, paint for preſerving nets, &c. Acids have a greater affinity with leads than oils have. If the common plaſter, compoſed of oil and litharge, be boiled in diſtilled vinegar, the litharge will be diſſolved, and the oil thrown up to the top. The oil thus recovered, proves ſoluble like eſſential oils in ſpirit of wine; a phenomenon firſt taken notice of by Mr Geoffroy.

§ 6. *TIN.*

THE colour of this metal reſembles ſilver, but is ſomewhat darker. It is ſofter, leſs elaſtic, and ſonorous, than any other metal except lead. When bent backwards and forwards, it occaſions a crackling ſound, as if torn aſunder. It is the lighteſt of all the malleable metals, being little more than ſeven times ſpecifically heavier than water. The tenacity of its parts alſo is not very conſiderable; a tin wire of $\frac{1}{10}$ of an inch diameter being able to ſupport only 49½ pounds.

1217 Capable of being beat into thin leaves.

Tin is commonly reckoned the leaſt ductile of all metals except lead, and certainly is ſo, in regard to ductility into wire, but not in regard to extenſibility into leaves. Theſe two properties ſeem not to be ſo much connected with one another as is generally imagined. Iron and ſteel may be drawn into very fine wire, but cannot be beat into leaves. Tin, on the other hand, may be beat into very thin leaves, but cannot be drawn into wire: gold and ſilver poſſeſs both properties in a very eminent degree; whilſt lead, notwithſtanding its flexibility and ſoftneſs, cannot be drawn into fine wire, or beat into thin leaves. It melts the moſt eaſily of all the metals; about the 430th degree of Fahrenheit's thermometer. Heated till almoſt ready to melt, it becomes ſo brittle that large blocks may be eaſily beat to pieces by a blow. The purer ſort, from its facility of breaking into long ſhining pieces, is called *grain-tin*. Melted, and nimbly agitated at the inſtant of its beginning to congeal, it is reduced into ſmall grains or powder.

1218 Calcined.

With the heat neceſſary for fuſion, it may alſo be calcined; or at leaſt ſo far deprived of its phlogiſton as to appear in the form of a grey calx, which may be entirely reduced to tin by the addition of inflammable matter. The calcination of tin, like that of lead, begins by the melted metal loſing its brightneſs, and contracting a pellicle on its ſurface. If the fire is raiſed to a cherry-red, the pellicle ſwells and burſts, diſcharging a ſmall bright flame of an arſenical ſmell. By longer continuance in the fire, the metal is converted firſt into a greyiſh, and then into a perfectly white calx, called *putty*, which is uſed for poliſhing glaſs and other hard bodies.

The calx of tin is the moſt refractory of all others. Even in the focus of a large burning mirror, it only ſoftens a little, and forms cryſtalline filaments. With glaſs of biſmuth, and the ſimple and arſenicated glaſſes of lead, it forms opaque milky compounds. By this property it is fitted for making the baſis of the imperfect glaſſes called *enamels*; (ſee GLASS and ENAMEL). The author of the Chemical Dictionary relates, "that having expoſed very pure tin, ſingly, to a fire as ſtrong as that of a glaſs-houſe furnace, during two hours, under a muffle, in an uncovered teſt, and having then examined it, the metal was found covered with an exceedingly white calx, which appeared to have formed a vegetation; under this matter was a reddiſh calx, and an hyacinthine glaſs; and laſtly, at the bottom was a piece of tin unaltered. The experiment was ſeveral times repeated with the ſame ſucceſs."

1219 Affinity of tin with arſenic.

Nitre deflagrates with tin, and haſtens the calcination of this as well as of other imperfect metals. The vapours which riſe from tin, by whatever method it is calcined, have generally an arſenical ſmell. Tin melted with arſenic falls in great part into a whitiſh calx: the part which remains uncalcined proves very brittle, appears of a white colour, and a ſparkling plated texture, greatly reſembling zinc. The arſenic is ſtrongly retained by the tin, ſo as ſcarcely to be ſeparable by any degree of fire; the tin always diſcovering, by its augmentation in weight, that it holds a portion of arſenic, though a very intenſe fire has been uſed. Hence, as the tin ores abound in arſenic, the common tin is found alſo to participate of that mineral.

1220 Arſenic ſeparable from tin.

Henckel diſcovered a method of ſeparating actual arſenic from tin; namely, by ſlowly diſſolving the tin in eight times its quantity of an aqua-regia made with ſal ammoniac, and ſetting the ſolution to evaporate in a gentle warmth: the arſenic begins to concrete whilſt the liquor continues hot, and more plentifully on its growing cold, into white cryſtals. M. Margraaf, in the Berlin Memoirs for 1746, has given a more particular account of this proceſs. He obſerves, that the white ſediment which at firſt ſeparates during the diſſolution, is chiefly arſenical; that Malacca tin, which is accounted one of the pureſt ſorts, yielded no leſs than $\frac{1}{8}$th its weight of arſenical cryſtals; that ſome ſorts yielded more; but that tin extracted from a particular kind of ore, which contained no arſenic, afforded none. That the cryſtals were truly arſenical, and appeared from their being totally volatile; from their ſubliming (a little fixed alkaline ſalt being added to abſorb the acid) into a colourleſs pellucid concrete; from the ſublimate, laid on a heated copper-plate, exhaling in fumes of a garlic ſmell; from its ſtaining the copper white: and from its forming, with ſulphur, a compound ſimilar to the yellow or ſulphurated arſenic. He found that the arſenic was ſeparable alſo by means of mercury; an amalgam of tin being long triturated with water, and the powder which was waſhed off committed to diſtillation, a little mercury came over, and bright arſenical flowers aroſe in the neck of the retort.

1221 Dr Lewis's obſervation.

Dr Lewis obſerves, that the crackling noiſe of tin in bending may poſſibly ariſe from its arſenic; as thoſe operations which are ſaid to ſeparate arſenic from the metal, likewiſe deprive it of this property.

Tin may be allayed, in any proportion, with all metals by fuſion: but it abſolutely deſtroys their ductility, and renders them brittle, as in bell-metal; whence this metal has obtained the name of *diabolus metallorum*.

1222 Injurious to other metals.

Iron is diſſolved by tin in a heat far leſs than that in which iron itſelf melts; the compound is white and brittle. Iron added to a mixture of lead and tin, takes up the tin, leaving the lead at the bottom; and in like manner, if lead, tin, and ſilver, are melted together, the addition of iron will abſorb all the tin, and the tin only. Hence an eaſy method of purifying ſilver from tin.

1223 Not liable to ruſt.

Tin notwithſtanding it is, like lead, ſoon deprived of its luſtre by expoſure to the air, is nevertheleſs much leſs liable to ruſt than either iron, copper, or lead; and hence is advantageouſly uſed for covering over the inſides of other metalline veſſels. The amalgam of mercury and tin is employed to cover one of the ſurfaces of looking-glaſſes; by which they are rendered capable of reflecting the rays of light.

1224 Aurum moſaicum.

The amalgam alſo, mixed with ſulphur and ſal ammoniac, and ſet to ſublime, yields a ſparkling gold-coloured ſubſtance called *aurum moſaicum*; which is ſometimes uſed as a pigment. This preparation is commonly made from quickſilver and tin, of each two parts, amalgamated together; and then thoroughly mixed with ſulphur and ſal ammoniac, of each one part and a half. The mercury and ſulphur unite into a cinnabar, which ſublimes along with the ſal ammoniac; and, after ſublimation, the aurum moſaicum remains at the bottom.

Sulphur may be united with tin by fuſion; and forms with it a brittle maſs, more difficultly fuſible than pure tin. Sulphur has, in this reſpect, the ſame effect upon tin as upon lead. The allay of tin leſſens the fuſibility of theſe very fuſible metals, while it increaſes the fuſibility of other difficultly fuſible metals, as iron and copper.

§ 7. *MERCURY or QUICKSILVER.*

MERCURY is a fluid metallic ſubſtance, of a bright ſilver colour, reſembling lead or tin when melted; entirely void of taſte and ſmell; extremely diviſible; and congealable only in a degree of cold very difficultly produced, in this country, by art (ſee COLD and CONGELATION).

1225 Heavier in winter than in ſummer.

It is the moſt ponderous of all fluids, and of all known bodies, gold and platina excepted; its ſpecific gravity being to that of water nearly as 14 to 1. It is found to be ſpecifically heavier in winter than in ſummer by 25 grains in 11 ounces.

Neither air nor water, nor the united action of theſe two, ſeem to make any impreſſion upon mercury: nor is it more ſuſceptible of ruſt than the perfect metals. Its ſurface, nevertheleſs, is more quickly tarniſhed than gold or ſilver; becauſe the duſt which floats in the air, quickly ſeizes on its ſurface. The watery vapours alſo, which float in the air, ſeem to be attracted by mercury.

1226 Purification.

From theſe extraneous matters, which only ſlightly adhere to it, mercury may be eaſily cleanſed by paſſing it through a clean new cloth, and afterwards heating it: but if mixed with any other metal, no ſeparation can be effected without diſtillation. In this proceſs, a ſmall portion of ſome of the metals generally ariſes along with the mercury. Thus, quickſilver

1227 Curious mercuries by Boyle.

ver diſtilled from lead, biſmuth, or tin, appears leſs bright than before; ſtains paper black; ſometimes exhibits a ſkin upon the ſurface; and does not run freely, or into round globules. Mr Boyle relates, that he has obſerved the weight of mercury ſenſibly increaſed by diſtillation from lead, and this when even a very moderate fire was made uſe of. By amalgamation with ſtellated regulus of antimony, and then being diſtilled after a few hours digeſtion, mercury is ſaid to become, by a few repetitions of the proceſs, more ponderous, and more active. The animated, or philoſophic mercuries of ſome of the alchemiſts, are ſuppoſed to have been mercury thus prepared. By the ſame, or ſimilar proceſſes, ſeem to have been obtained the curious mercuries which Boyle declared he was poſſeſſed of, and made himſelf; which were "conſiderably heavier in ſpecie than common quickſilver,—diſſolved gold more readily,—grew hot with gold, ſo as to be offenſive to the hand, and elevated gold in diſtillation." When quickſilver is to be diſtilled, it is proper to mingle it with a quantity of iron-filings; which have the property of making it much brighter than it can be otherwiſe obtained, probably by furniſhing phlogiſton.

1228 Mercurius precipitatus per ſe.

1229 Mercury unalterable by a gentle heat;

By digeſtion in a ſtrong heat for ſeveral months, mercury undergoes a conſiderable alteration, changing into a powder, at firſt aſh-coloured, afterwards yellow, at length of a bright red colour, and an acrid taſte; and is then called *mercurius precipitatus per ſe*. In this laſt ſtate it proves ſimilar to the red precipitate, prepared from a ſolution of mercury in nitrous acid. This calx proves leſs volatile in the fire than the mercury in its fluid ſtate. It ſupports for ſome time even a degree of red heat. In the focus of a burning mirror, it is ſaid to melt into glaſs when laid upon a piece of charcoal, and to revive into running mercury before it exhales. Evaporated by common fire, it leaves a ſmall portion of a light brown powder; which, Boerhaave relates, bore a blaſt-heat; ſwelled into a ſpongy maſs; formed with borax a vitreous friable ſubſtance; but vaniſhed in cupellation. By a long continued digeſtion in a gentle heat, mercury ſuffers little change. Boerhaave digeſted it in low degrees of heat, both in open and cloſe veſſels, for 15 years together, without obtaining any other reward for his labour than a ſmall quantity of black powder; which, by trituration, was quickly revived into running mercury. Conſtant triture. or agitation, produce a change ſimilar to this in a ſhort time. Both the black and red powders, by bare expoſure to a fire ſufficient to elevate them, return into fluid mercury. The red powder has been revived by ſimply grinding it in a glaſs mortar.

1230 Or by diſtillation.

1231 Exploſion by the vapours of mercury.

In like manner, quickſilver remains unchanged by diſtillation. Boerhaave had the patience to diſtil 18 ounces of mercury upwards of 500 times over, without obſerving any other change than that its fluidity and ſpecific gravity were a little increaſed, and that ſome grains of a fixed matter remained. The vapours of mercury, like thoſe of all other volatile bodies, cauſe violent exploſions if confined. Mr Hellot gives an account of his being preſent at an experiment of this kind: a perſon pretending to fix mercury, had incloſed it in an iron box cloſely welded. When the mercury was heated, it burſt the box, and diſſipated in inviſible vapours.

1232 Amalgamated with different ſubſtances.

Mercury diſſolves or unites with all metallic bodies, except three, *viz.* iron, arſenic, and nickel: in ſome caſes it will abſorb metals, particularly gold and ſilver, from their ſolutions in acids or alkalies; but does not act upon any metal when combined with ſulphur, nor on precipitates made by alkalies, nor on calces by fire. Whatever metal it is united with, it conſtantly preſerves its own white colour. It unites with any proportion of thoſe metallic ſubſtances with which it is capable of being combined; forming, with different quantities, amalgams of different degrees of conſiſtence. From the fluid ones, greateſt part of the quickſilver may be ſeparated by colature. Biſmuth is ſo far attenuated by mercury, as to paſs through leather with it in conſiderable quantity. It alſo promotes the action of quickſilver upon lead to a great degree; ſo that mercury united with $\frac{1}{4}$, $\frac{1}{8}$, or $\frac{1}{16}$ its weight of biſmuth, diſſolves maſſes of lead in a gentle warmth, without the agitation, triture, comminution, or melting heat neceſſary to unite pure mercury with lead. From theſe properties, this ſolution of biſmuth in mercury becomes a proper ſolvent for pieces of lead lodged in the human body.

1233 Separation of the amalgamated metal.

On triturating or digeſting amalgams for a length of time, a blackiſh or duſky coloured powder ariſes to the ſurface, and may be readily waſhed off by water. Some of the chemiſts have imagined, that the amalgamated metal was here reduced to its conſtituent parts: but pure mercury is by itſelf reducible to a powder of the ſame kind, and the metallic particles in this proceſs, united with the mercury, are found to be no other than the metal in its entire ſubſtance. Some metals ſeparate more difficultly than others; gold and ſilver the moſt ſo. Boerhaave relates, that if the powder which ſeparates from an amalgam of lead be committed to diſtillation with vinegar in a tall veſſel, the mercury will ariſe before the vinegar boils; that, by a like artifice, quickſilver may be made to diſtil in a leſs degree of heat than that of the human body: but Dr Lewis, though he made many trials, was never able to ſucceed.

1234 Becomes fixed by amalgamation with gold.

By amalgamation with gold, mercury may become exceedingly fixed; ſo as not to be diſſipable by the greateſt heat. Concerning this, Dr Brandt relates the following curious experiment: "Having amalgamated fine gold with a large proportion of quickſilver, and ſtrained off the ſuperfluous mercury, he digeſted the amalgam in a cloſe ſtopped veſſel for two months with ſuch a degree of heat, that a part of the quickſilver ſublimed into the neck of the glaſs. The matter being then ground with twice its weight of ſulphur, and urged with a gradual fire in a crucible, a ſpongy calx remained; which being melted with borax, and afterwards kept in fuſion by itſelf for half an hour, in a very violent fire, ſtill remained ſo much of the quickſilver as to become brittle under the hammer, and appear internally of a leaden colour. The metal being again amalgamated with freſh mercury, the amalgam again ground with ſulphur, and expoſed to an intenſe fire, a ſpongy calx remained as before. This calx being digeſted in two or three freſh parcels of aqua-regia, a ſmall portion of whitiſh matter remained ed at laſt undiſſolved. The paper which covered the cylindrical glaſs wherein the digeſtion was performed, contracted, from the vapours, a deep-green circular ſpot in the middle, with a ſmaller one at the ſide; whereas the aqua-regia digeſted in the ſame manner by itſelf, or with gold, or with mercury, gave no ſtain. The firſt ſolution, on the addition of oil of tartar *per deliquium*, grew red as blood; on ſtanding, it depoſited, firſt, a little yellow calx, like aurum fulminans; afterwards, a bright matter like fine gold; and at laſt, a paler precipitate, inclining to green; its own deep red colour and tranſparency remaining unchanged. Being now committed to diſtillation, a colourleſs liquor aroſe; and the reſiduum, perfectly exſiccated, yielded, on edulcoration, a yellow calx of gold; which the alakaline lixivium had been unable to precipitate. The ſecond ſolution turned green on the admixture of the alkaline liquor, and let fall a white precipitate, which turned black and brown. The ſeveral precipitates were calcined with twice their weight of ſulphur, and then melted with four times their quantity of flint, and twelve of pot-aſh, in a fire vehemently excited by bellows. The ſcoria appeared of a golden colour, which, on pulverization and edulcoration, vaniſhed. At the bottom was a regulus, which looked bright like the pureſt gold; but was not perfectly malleable. Broken, it appeared internally white; and the white part amounted to at leaſt one-third its bulk. Beſides this lump of metal, there were ſeveral others, white like ſilver, and ſoft as lead."

1235 Suppoſed to be convertible into water. In Wilſon's chemiſtry, we have a proceſs for converting quickſilver into water, by dropping it by little and little into a tall iron veſſel, heated almoſt to a white heat in the bottom. Over the mouth of this veſſel were luted ſeven aludels; and on the top, a glaſs alembic head, with a beak, to which was fitted a receiver. The mercury was put in ſo ſlowly, that it required 16 hours for one pound. Every time that a little quantity of mercury was put in, it made a great noiſe, filling the aludel's head and receiver with white fumes. When the veſſels were cooled, a little water was found in each of the receivers, and in the firſt and ſecond ſome grains of crude mercury. The whole quantity amounted to 13 ounces and 6 drachms; which was expected to prove a powerful ſolvent of gold and ſilver: but, on trial, was found to be in no reſpect different from common water. On this experiment Dr Lewis has the following note.

1236 Dr Lewis's detection of the falſehood of this proceſs. "The poſſibility of converting mercury into water, or at leaſt of obtaining a great quantity of water from mercury, has not only been believed by ſeveral great men in the chemical art, but ſome have even ventured to aſſert that they have actually made this change. Yet, nevertheleſs, they have delivered the hiſtory of this affair with ſuch marks, as ſeem to make the reality of the change extremely doubtful. Mr Boyle (in his tract *of the producibeneſs of Chemical Principles*, annexed to *Scept. Chemiſt.* p. 235) ſays, "that he once obtained water from mercury without additament, without being able to make the like experiment ſucceed afterwards." M. Le Febure, who is generally looked upon as an honeſt practitioner, directs a proceſs ſimilar to that above (Wilſon's), for obtaining of this mercurial water. But it is to be ſuſpected, as Mr Hales very well obſerves (in his *Statical Experiments*, p. 200.), that Mr Boyle and others were deceived by ſome unheeded circumſtance, when they thought they obtained a water from mercury, which ſhould ſeem rather to have ariſen from the lute and earthen veſſels made uſe of in the diſtillation: for Mr Hales could not find the leaſt ſign of any moiſture upon diſtilling mercury in a retort made of an iron gun-barrel, with an intenſe degree of heat; although he frequently cohobated the mercury which came over into the recipient. "In a courſe of chemical experiments, I repeated Mr Hales's proceſs, and urged the mercury, which was let fall by little and little, through an aperture made in the gun-barrel, with a moſt intenſe degree of heat, without obtaining any water; but it being ſuſpected by a byſtander, that the mercury in this experiment came over before it had been ſufficiently acted upon by the fire, by reaſon of the lowneſs of the neck of the diſtilling inſtrument, the experiment was varied in the following manner. Sixteen ounces of mercury were heated in a crucible, in order to evaporate any moiſture that might have been accidentally mixed with it; and an iron gun-barrel of four feet in length, being placed perpendicularly in a good furnace, and a glaſs-head and recipient fitted to its upper part, the mercury was let fall by little and little into the barrel, and the fire urged with bellows. After each injection, the mercury made a conſiderable noiſe and ebullition, and aroſe into the head; where it ſoon condenſed and trickled down, in the common form of running mercury, into the recipient, without the leaſt perceptible appearance of any aqueous humidity."

1237 How to amalgate with regulus of antimony. Mercury is difficultly amalgamated with regulus of antimony and copper; for which ſome particular manœuvres are required. Two of Dr Lewis's receipts for uniting quickſilver with copper, we have already given (n° 1153.): with regulus of antimony, mercury, he ſays, may be perfectly united, by pouring a ſmall ſtream of melted regulus into a conſiderable portion of mercury, made almoſt boiling hot. Another method directed by Henckel, is to put mercury into an iron mortar along with ſome water, and ſet the whole over the fire. When the water boils, a third or fourth part of melted regulus is to be poured in, and the maſs ground with a peſtle, till the amalgam is completed. The uſe of the water, as Dr Lewis obſerves, is to hinder the mercury from flying off by the heat of the regulus: but as the two are by this means not put together in ſo hot a ſtate, the union is more difficult, and leſs perfect. The loſs of the mercury, in the firſt proceſs, may be prevented by uſing a large veſſel, and covering it with a perforated iron-plate, through the hole in which the regulus is to be poured. This method is likewiſe applicable to the amalgamation of copper.

With ſulphur, mercury unites very readily, forming by trituration, or ſimple fuſion, a black powder or maſs, called *Ethiops mineral*; which, by careful ſublimation, becomes the beautiful red pigment called *vermillion*. (See SULPHUR, ſect. iv.).

1238 Preparations of mercurius dulcis in the moiſt way. The extenſive uſe of mercurius dulcis in medicine has rendered it an object to chemiſts to find out ſome method of preparing it with leſs expence and trouble, and with more certainty of its effects, than it can be by the methods hitherto mentioned. This is now accompliſhed

Mercury of quick-ſilver.

pliſhed through the induſtry of Mr Scheele, to whom chemiſtry in general has been ſo much obliged. His method is as follows:

"Take half a pound of quickſilver, and as much pure common aquafortis. Pour it into a ſmall cucurbit with a pretty long neck, ſtop the mouth with a little paper, and put it into warm ſand. Some hours afterwards, when the acid appears no longer to act upon the quickſilver, the fire is to be augmented ſo as to make the ſolution nearly boil. This heat is to be continued for three or four hours, and the veſſel now and then to be ſhaken. Towards the end, regulate the heat in ſuch a manner that the ſolution ſhall gently boil for a quarter of an hour. In the mean time, diſſolve 4½ ounces of pure common ſalt in ſix or eight pounds of water; pour this ſolution, ſtill boiling, into a glaſs veſſel, and immediately afterwards mix with it the abovementioned ſolution of quickſilver, which alſo muſt be boiling, in ſmall quantities at a time, with conſtant agitation. When the precipitate has ſettled, decant off the clear liquor, and pour hot water again on the precipitate, with which it is to be edulcorated till the water ſtanding upon it ſhall be entirely taſteleſs. Put the whole, obtained by theſe means, together, filter and dry it in a mild heat."

1239 How to obtain a perfectly ſaturated ſolution of quickſilver.

On this proceſs it is remarked, that when the quickſilver no longer effervesces with the acid, one would imagine that a ſaturation had taken place. But this is far from being the caſe. By increaſing the heat the ſolution is ſtill able to diſſolve a great quantity; with this difference, however, that, whereas the quickſilver in the beginning is calcined, a great deal of it afterwards, in a metallic form, is diſſolved, as appears from this, that not only no more elaſtic vapours aſcend; but alſo, that with fixed and volatile cauſtic alkalies, a black precipitate is obtained; otherwiſe, when the ſolution contains only calcined quickſilver, the precipitate is yellow. If the black precipitate be gently diſtilled, quickſilver ariſes, and there remains a yellow powder, which is that part of the metal that was calcined by the nitrous acid. The fire muſt at any rate be augmented, in order to keep the mercurial calx diſſolved, the compound of this metal and nitrous acid being extremely apt to cryſtallize even in the heat. There commonly remains ſome undiſſolved quickſilver; but it is always better to take too much than too little; for the more metal the mercurial ſolution contains, the more mercurius dulcis is obtained at laſt. The quantity here mentioned uſually produces 8½ ounces of mercurius dulcis. The mercurial ſolution muſt be cautiouſly poured into that of ſea-ſalt, that no mercury may follow. Two ounces of ſalt would be ſufficient for the precipitation of all the quickſilver; but when ſo ſmall a quantity is uſed, it may eaſily happen, that ſome ſuperabundant corroſive ſublimate may adhere to the precipitate, which water alone is incapable of entirely ſeparating. Among other advantages this method of making mercurius dulcis poſſeſſes, it is none of the leaſt, that the powder is much finer than any to which it can be reduced in the common way by trituration, however long continued.

§ 8. ZINC.

Zinc.

This is a ſemimetal of a bluiſh white colour. It is the leaſt brittle of any of the ſemimetals; and when amply ſupplied with phlogiſton, which may be done by treating it in cloſe veſſels with inflammable matters, it poſſeſſes a ſemiductility, by which it may be flattened into thin plates. When broken, it appears formed of many flat ſhining plates or facets, which are larger when ſlowly than when haſtily cooled. When heated, it is very brittle; and crackles like tin, only louder, when bent. Expoſed to the air, it contracts in length of time a yellowiſh ruſt. Its ſpecific gravity, according to Dr Lewis, is to that of water as 7¼ to 1.

1240 Deflagration.

It begins to melt as ſoon as red-hot; but does not flow thin till the fire is raiſed to a white heat. Then the zinc immediately begins to burn with an exceedingly bright and beautiful flame. Kept juſt in fuſion, it calcines ſlowly; not only on the upper ſurface, but likewiſe round the ſides, and at the bottom of the crucible. If ſeveral pieces are juſt melted together, the maſs, when grown cold, may be broken into the ſame number; their union being prevented by a yellowiſh calx, with which each piece is covered over. M. Malouin relates, in the French Memoirs for 1742, that a quantity of zinc being melted ſix times, and the fuſion continued fifteen hours each time, it proved, on every repetition, harder, more brittle, leſs fuſible, and leſs calcinable; that after the two firſt fuſions, its colour was grey; after the third, brown; and after the fourth, black; that the fifth rendered it of a ſlate-blue; and the ſixth of a clear violet.

1241 Flowers of zinc.

So violent is the deflagration of zinc, that the whole of its calx is ſublimed by it, in the form of light flocks of wool; which, however, are eaſily reduced to a fine powder. Theſe are uſed in medicine, and reckoned an excellent remedy in epileptic caſes. When once ſublimed, they are by no means capable of being elevated again by the moſt violent heat. In a heat far greater than that in which they firſt aroſe, they ſuffer no alteration; in a very vehement one, they melt, according to Henckel, into a ſemiopaque green glaſs. Vitrified with borax, they give a grey, or browniſh, glaſs. From the brightneſs of the flame of burning zinc, and the garlic ſmell which it is ſaid to emit, ſome have concluded that zinc contained the phoſphorine acid; which, from ſome other circumſtances, is not altogether improbable.

1242 Dr Lewis's method of reducing them.

The flowers of zinc have been thought very difficultly, or not at all, reducible to their metallic form by an addition of phlogiſton. But Dr Lewis obſerves, that this difficulty proceeds not from their unfitneſs to be reſtored into the form of zinc, but from the volatility of the ſemimetal, which occaſions its being diſſipated in fumes, if the common methods are made uſe of. All calces, theſe of iron excepted, require a greater heat for their fuſion than that in which the metal itſelf melts; and as a full melting heat is the greateſt that zinc can ſuſtain, it burns and calcines the inſtant of its revival, if the air is admitted; and in cloſe veſſels eſcapes, in part at leaſt, through their pores. On mixing flowers of zinc with powdered charcoal, and urging them with a ſtrong fire in a crucible, a deflagration and freſh ſublimation enſue: ſufficient marks that the zinc has been reduced to its metallic form; for as long as it remains in the ſtate of calx, neither of theſe effects can happen. If the veſſel is ſo contrived as to exclude the air, and at the ſame time to allow the reviving ſemimetal to run off from the vehemence of the heat, into a receiver kept cool, the zinc will there concrete, and be preſerved in its metallic ſtate. It is ſtill more effectually detained by certain metallic bodies, as copper, or iron; with which the zinc, when thus applied, unites more readily and perfectly than it can be made to do by any other means.

1243 Oil from flowers of zinc by Mr Homberg.

Homberg pretended to obtain an oil from the flowers of zinc, by diſſolving them in diſtilled vinegar, and then diſtilling the ſolution in a glaſs retort. At firſt a quantity of phlegm aroſe; then the ſuperfluous acid; and at laſt an empyreumatic oil. This laſt, which Homberg imagined to proceed from the flowers of zinc, Newmann very juſtly attributes to the diſtilled vinegar.

1244 Another by Mr Hellot.

An oil of another kind was obtained by Mr Hellot from the above ſolution, by digeſting the aſh-coloured reſiduum, which remained after the diſtillation, with the acidulous phlegm which came over, for eight or ten days; diſtilling the tincture to dryneſs; and repeating the extraction with the diſtilled liquor, till the quantity of dry extract thus obtained was very conſiderable. This reſin-like matter, diſtilled in a retort with a ſtronger fire, yielded a yellowiſh liquor, and a white ſublimate. The liquor diſcovered no mark of oil; but, upon being paſſed upon the ſublimate, immediately diſſolved it, and then exhibited on the ſurface ſeveral drops of a reddiſh oil. Some of this oil was taken up on the point of a pencil, and applied to gold and ſilver-leaf. In twenty-four hours the parts touched appeared, in both, equally diſſolved.

1245 Zinc with other metals.

Zinc does not unite in fuſion with biſmuth, or the ſemimetal called *nickel*. It unites difficultly with iron; leſs ſo with copper; eaſier with the other metals. It renders iron or copper more eaſily fuſible; and, like itſelf, brittle whilſt hot, though conſiderably malleable when cold. It brightens the colour of iron almoſt into a ſilver hue, and changes that of copper into a yellow or gold colour. It greatly debaſes the colour of gold; and renders near an hundredth part of that moſt ductile metal brittle and untractable. A mixture of equal parts of each is very hard, white, and bears a fine poliſh; hence it is propoſed by Mr Hellot for making ſpecula. It is not ſubject to ruſt or tarniſh in the air, like thoſe metals whoſe baſis is copper. It improves the colour and luſtre of lead and tin, renders them firmer, and conſequently fitter for ſeveral mechanic uſes. Tin, with a ſmall proportion of zinc, forms a kind of pewter. Lead will bear an equal weight, without loſing too much of its malleability. Malouin obſerves, that arſenic, which whitens all other metals, renders zinc black and friable; that when the mixture is performed in cloſe veſſels, an agreeable aromatic odour is perceived on opening them: that zinc amalgamated with mercury, and afterwards recovered, proves whiter, harder and more brittle than before, and no longer crackles on being bent.

1246 Materials for ſpecula.

1247 Deflagration of zinc with other metals.

Mixtures of zinc with other metals, expoſed to a ſtrong fire, boil and deflagrate more violently than zinc by itſelf. Some globules of the mixture are uſually thrown off during the ebullition, and ſome part of the metal calcined and volatilized by the burning zinc: hence this ſubſtance has been called *metallic nitre*. Gold itſelf does not entirely reſiſt its action. It very difficultly volatilizes copper; and hence the ſublimates obtained in the furnaces where braſs is made, or mixtures of copper and zinc melted, are rarely found to participate of that metal. On melting copper and zinc ſeparately, and then pouring them together, a violent detonation immediately enſues, and above half the mixture is thrown about in globules.

1248 Cannot be united with ſulphur.

Zinc does not unite in the leaſt with ſulphur, or with crude antimony, which ſcorify all other ſubſtances except gold and platina; nor with compoſitions of ſulphur and fixed alkaline ſalts, which diſſolve gold itſelf. With nitre it deflagrates violently. Its flowers do not ſenſibly deflagrate; yet alkalize double their weight of the ſalt more readily than the zinc itſelf. The alkaline maſs appears externally greeniſh, internally of a purple colour. It communicates a fine purple to water, and a red to vinegar. The acetous tincture inſpiſſated, leaves a tenacious ſubſtance which ſoon runs in the air into a dark red cauſtic liquor, the alkaheſt of ſome of the pretended adepts.

1249 Nitre alkalized by flowers of zinc.

§ 9. *BISMUTH.*

THIS ſemimetal, called, alſo *tin-glaſs*, and by ſome naturaliſts *marcaſita officinarum*, is ſomewhat ſimilar to the regulus of antimony. It appears to be compoſed of cubes formed by the application of plates upon each other. Its colour is leſs white than that of regulus of antimony; and has a reddiſh tinge, particularly when it is expoſed to the air. In ſpecific gravity it approaches to ſilver; being nearly ten times heavier than water. It has no degree of malleability; breaking under the hammer, and being reducible by trituration to fine powder. It melts a little later than tin, and ſeems to flow the thinneſt of all metallic ſubſtances. Biſmuth is ſemivolatile, like all other ſemimetals. When expoſed to the fire, flowers riſe from it; it is calcined; and converted into a litharge and glaſs, nearly as lead is; (See GLASS). It may even be employed, like that metal, in the purification of gold and ſilver by cupellation. (See REFINING). When in fuſion, it occupies leſs volume than in its ſolid ſtate: a property peculiar to iron among the metals, and biſmuth among the ſemimetals. It emits fumes in the fire as long as it preſerves its metallic form; when calcined or vitrified, it proves perfectly fixed.

1250 Convertible into litharge and glaſs.

1251 Promotes the fuſion of all the metals,

Biſmuth mingles in fuſion with all the metalline ſubſtances, except regulus of cobalt and zinc. The addition of nickel or regulus of antimony, renders it miſcible with the former, though not with the latter. It greatly promotes the tenuity as well as facility of the fuſion of all thoſe metals with which it unites. It whitens copper and gold, and improves the colour of ſome of the white metals: mixed in conſiderable quantity; it renders them all brittle, and of a flaky ſtructure like its own. If mixed with gold or ſilver, a heat that is but juſt ſufficient to melt the mixture, will preſently vitrify a part of the biſmuth; which, having then no action on thoſe perfect metals, ſeparates, and glazes the crucible all round.

§ 10. *Regulus of Antimony.*

1252 Appearance of a ſtar on its ſurface.

This ſemimetal, when pure, and well fuſed, is of a white ſhining colour, and conſiſts of laminæ applied to each other. When it has been well melted, and not too haſtily cooled, and its ſurface is not touched by any hard body during the cooling, it exhibits the perfect figure of a ſtar, conſiſting of many radii iſſuing from a centre. This proceeds from the diſpoſition that the parts of this ſemimetal have to arrange themſelves in a regular manner, and is ſimilar to the cryſtallization of ſalts.

1253 Sublimable.

Regulus of antimony is moderately hard; but, like other ſemimetals, it has no ductility, and breaks in ſmall pieces under a hammer. It loſes $\frac{1}{7}$ of its weight in water. The action of air and water deſtroys its luſtre, but does not ruſt it ſo effectually as iron or copper. It is fuſible with a heat ſufficient to make it red hot; but when heated to a certain degree, it fumes continually, and is diſſipated in vapours. Theſe fumes form what are called the *argentine flowers* of regulus of antimony, and are nothing but the earth of this ſemimetal deprived of part of its inflammable principle, and capable of being reduced to its reguline ſtate by an union with this principle.

1254 Separation of the ſulphur from antimony.

There are different methods of preparing the regulus of antimony; but all of them conſiſt merely in ſeparating the ſulphur which this mineral contains, and which is united with the regulus. It is plain, therefore, that regulus of antimony may be made by an addition of any ſubſtance to crude antimony in fuſion, which has a greater attraction for ſulphur than the regulus itſelf has. For this purpoſe, alkaline ſalts have been employed, either previouſly prepared, or extemporaneouſly produced in the proceſs, by a deflagration of tartar and nitre. By this means, the ſulphur was indeed abſorbed; but the hepar ſulphuris, formed by the union of the ſulphur and alkali, immediately diſſolved the regulus, ſo that very little, ſometimes none at all, was to be obtained diſtinct from the ſcoria. Metals are found to anſwer better than alkaline ſalts, but the regulus is ſeldom or never free from a mixture of the metal employed. The way of obtaining a very pure regulus, and in great quantity, is to calcine the antimony in order to diſſipate its ſulphur; then to mix the calx with inflammable matters, ſuch as oil, ſoft ſoap, &c. which are capable of reſtoring the principle of inflammability to it. This method was invented by Kunckel. Another, but more expenſive way of procuring a large yield of very pure regulus, is, by digeſting antimony in aqua-regis, which diſſolves the reguline part, leaving the ſulphur untouched, precipitating the ſolution, and afterwards reviving the precipitate by melting it with inflammable matters.

1255 Regulus eaſily miſcible with mercury.

There are conſiderable differences obſerved in the regulus of antimony, according to the different ſubſtances made uſe of to abſorb the ſulphur. When prepared by the common methods, it is found to be very difficultly amalgamated with mercury; but Mr Pott has diſcovered, that a regulus prepared with two or five parts of iron, four of antimony, and one of chalk, readily unites with mercury into an hard amalgam, by bare trituration with water. Marble and quicklime ſucceed equally well with chalk; but clay, gypſum, or other earths, have no effect.

1256 Extemporaneous regulus with cawk.

One earthy ſubſtance, found in lead-mines, and commonly called *cawk*, has a very remarkable effect upon antimony. This is found in whitiſh, moderately compact and ponderous maſſes; it is commonly ſuppoſed a ſpar; but differs from bodies of this kind, in not being acted upon by acids, (ſee n° 1068). If a lump of cawk, of an ounce or two, be thrown red hot into 16 ounces of melted antimony, the fuſion continued about two minutes, and the fluid matter poured off, "you will have 15 ounces like poliſhed ſteel, and as the moſt refined quickſilver." *Phil. Tranſ.* n° 110. Dr Lewis mentions his having repeated this experiment ſeveral times with ſucceſs: but having once varied it by mixing the cawk and antimony together at the firſt, a part of the antimony was converted into a very dark black vitreous matter, and part ſeemed to have ſuffered little change; on the ſurface of the maſs ſome yellow flowers appeared.

1257 Glaſs of antimony.

Regulus of antimony enters into the compoſitions for metallic ſpeculums for teleſcopes, and for printing-types. It is alſo the baſis of a number of medicinal preparations; but many of theſe, which were formerly much eſteemed, are found to be either inert, uncertain, or dangerous in their operations. When taken in ſubſtance, it is emetic and purgative, but uncertain in its operation; becauſe it only acts in proportion to the quantity of ſolvent matter it meets with in the ſtomach; and if it meets with nothing capable of acting upon it there, the regulus will be quite inactive. For theſe reaſons, the only two preparations of antimony now retained, at leaſt by ſkilful practitioners, are the infuſion of glaſs of antimony in wine and emetic tartar. For making the glaſs of antimony we have the following proceſs. "Take a pound of antimony; reduce it to fine powder, and ſet it over a gentle fire; calcine it in an unglazed earthen pan, till it comes to be of an aſh colour, and ceaſes to fume: you muſt keep it continually ſtirring; and if it ſhould run into lumps, you muſt powder them again, and then proceed to finiſh the calcination. When that is done, put the calcined antimony into a crucible; ſet it upon a tile in a wind-furnace; put a thin tile on the top; and cover it all over with coals. When it is brought into fuſion, keep it ſo in a ſtrong fire for an hour: then put into it an iron rod; and when the melted antimony, which adheres to it, is tranſparent, pour it upon a ſmooth, hot, marble; and when it is cold, put it up for uſe. This is *vitrum antimonii*, or *ſtibium*."

1258 Difference of ſtrength in emetic tartars.

This preparation is more violent in its effects than the pure regulus itſelf; becauſe it contains leſs phlogiſton, conſequently is ſimilar to a regulus partially calcined, and ſo more ſoluble. Hence it is the moſt proper for infuſion in wine, or for making the tartar emetic. It is obviouſly, however, liable to great uncertainties in point of ſtrength; for as the antimony is more or leſs ſtrongly calcined, the glaſs will turn out ſtronger or weaker in its operation, and conſequently all the preparations of it muſt be liable to much uncertainty. This uncertainty is very apparent in the ſtrength of different parcels of emetic tartar: accordingly Mr Geoffroy found by examination of different emetic tartars, that an ounce of the weakeſt contain-

1259 Pulvis algaroth the moſt proper material for emetic tartar.

ed from 30 to 90 grains of regulus; an ounce of moderate ſtrength contained about 108 grains; and an ounce of the ſtrongeſt kind contained 154 grains. For theſe reaſons, the author of the Chemical Dictionary recommends the pulvis algaroth as the moſt proper material for making emetic tartar; being perfectly ſoluble, and always of an equal degree of ſtrength. Emetic tartar, as he juſtly obſerves, ought to be a metallic ſalt compoſed of cream of tartar ſaturated with the regulus of antimony; and M. Beaumé has ſhown ſuch a ſaturation to be poſſible, and that the neutral ſalt cryſtallizes in the form of pyramids. They are tranſparent while moiſt; but by expoſure to a dry air, they loſe the water of their cryſtallization and become opaque. The preparation of this ſalt, according to M. Baumé, conſiſts in mixing together equal parts of cream of tartar, and levigated glaſs of antimony: theſe are to be thrown gradually into boiling water; and the boiling continued till there is no longer any efferveſcence, and the acid is entirely ſaturated. The liquor is to be filtered; and upon the filter is obſerved a certain quantity of ſulphureous matter along with ſome undiſſolved parts of the glaſs of antimony. When the filtered liquor is cooled, fine cryſtals will be formed in it, which are a ſoluble tartar perfectly ſaturated with glaſs of antimony. He obſerves, that the diſſolution is ſoon over if the glaſs is well levigated, but requires a long time if it is only groſly pounded.

1260 Objection to its uſe.

1261 Scheele's theory of the nature of pulvis algaroth.

The trouble of levigating glaſs of antimony, as well as the uncertainty of diſſolving it, would render *pulvis algaroth* much preferable, were it not on account of its price; which would be a temptation to thoſe in uſe to prepare medicines, to ſubſtitute a cheaper antimonial preparation in its place. This objection, however, is now in a great meaſure removed by Mr Scheele; who demonſtrated that the pulvis algaroth is no other than regulus of antimony half calcined by the dephlogiſticated marine acid in the corroſive ſublimate made uſe of for preparing the antimonial cauſtic. If therefore we can fall upon any other method of dephlogiſticating the regulus, we ſhall then be able to combine the marine acid with it; and by ſeparating them afterwards, may have the powder of algaroth as good as from the butter of antimony itſelf. One of the methods of dephlogiſticating the regulus is by nitre. Our author therefore gives the following receipt for the powder in queſtion.

1262 His receipt for making it cheap.

"Take of powdered crude antimony one pound; powdered nitre, one pound and a half; which, after being well dried and mixed, are to be detonated in an iron mortar. The hepar obtained in this manner is to be powdered, and a pound of it to be put into a glaſs veſſel, on which firſt a mixture of three pounds of water and 15 ounces of vitriolic acid is to be poured, and afterwards 15 ounces of powdered common ſalt are to be added; the glaſs veſſel is then to be put in a ſandbath, and kept in digeſtion for 12 hours, during which period the maſs is to be conſtantly ſtirred. The ſolution, when cool, is to be ſtrained through linen. On the reſiduum one third of the above menſtruum is to be poured, and the mixture digeſted and ſtrained. From this ſolution, when it is diluted with boiling water, the pulvis algarothi precipitates, which is to be well edulcorated and dried."

1263 Golden ſulphur of antimony and kermes mineral.

As regulus of antimony, like other metallic ſubſtances, is ſoluble in liver of ſulphur, it happens, that, on boiling antimony in an alkaline ley, the ſalt, uniting with the ſulphur contained in that mineral, forms an hepar ſulphuris, which diſſolves ſome of the reguline part. If the liquor is filtered, and ſaturated with an acid, the regulus and ſulphur will fall together in form of a yellowiſh or reddiſh powder, called *golden ſulphur of antimony*. If the ley is ſuffered to cool, a like precipitation of a red powder happens. This laſt is called *kermes mineral*.

1263 Diaphoretic antimony.

1265 Crocus metallorum.

Nitre deflagrates violently with antimony, conſuming not only its ſulphureous part, but alſo the phlogiſton of the regulus: and thus reduces the whole to an inert calx, called *antimonium diaphoreticum*. If equal parts of nitre and antimony are deflagrated together, the ſulphureous part is conſumed, as well as part of the inflammable principle of the regulus. The metalline part melts, and forms a ſemivitreous maſs of reddiſh colour, called *crocus metallorum*, or *liver of antimony*. It is a violent emetic, and was formerly uſed for making infuſions in wine ſimilar to thoſe of glaſs of antimony; but is now diſuſed on account of its uncertainty in ſtrength. It is ſtill uſed by the farriers: but the ſubſtance ſold for it is prepared with a far leſs proportion of nitre; and ſometimes even without any alkaline ſalt being added to abſorb part of the antimonial ſulphur. This crocus is of a dull red colour; and, when powdered, aſſumes a dark purple.

§ II. *ARSENIC.*

1266 Arſenic found naturally in a metallic form.

THIS ſubſtance, in its natural ſtate, has no appearance of a metal, but much more reſembles a ſalt, which, as has been already obſerved, it really is when deprived of its phlogiſton. When united to a certain quantity of phlogiſton, it aſſumes a metallic appearance; and in this ſtate it is found, as Mr Bergman informs us, in Bohemia, Hungary, Saxony, Hercynia, and other parts; particularly at Alſatia in the mines called *St Marieux*. The maſſes in which it is found are frequently ſhapeleſs, friable, and powdery; but ſometimes compact, and divided into thick convex lamellæ, with a needle-formed or micaceous ſurface: it takes a poliſh, but ſoon loſes it again in the air. When freſh broken, it appears compoſed of ſmall needle-like grains of a leaden colour, ſoon becoming yellow, and by degrees blackiſh; exceeding copper in hardneſs, though as brittle as antimony.

1267 Regulus of arſenic eaſily converted into the common white kind.

Reguline arſenic, whether found naturally or prepared by art, very readily parts with as much of its phlogiſton as is ſufficient to make it fly off in a white ſmoke; but this ſtill retains a very conſiderable quantity of phlogiſtic matter, as is evident from its producing nitrous air by the affuſion of nitrous acid, and from the experiments already related of the preparation of the acid of arſenic. This calx indeed is the form in which arſenic is moſt commonly met with. It is leſs volatile than the regulus; and by ſublimation in a glaſs veſſel aſſumes an opaque cryſtalline appearance from becoming white on the ſurface; but that which cryſtallizes in the bowels of the earth does not appear to be ſubject to any ſuch change.

1268 White arſenic may be mixed with other metals.

White arſenic, though a true metalline calx, may be mixed in fuſion with the ſame metals which will unite with the regulus. This ſeems contrary to the general rule of other calces, which cannot be united with any metal in its metalline ſtate; but it muſt be remembered, that by this operation the arſenical calx is reduced to a regulus by the phlogiſton of the metal: whence, in all fuſions of this kind, ſome ſcoriæ riſe to the top, conſiſting of the calcined metal and part of the white arſenic.

1269 **Solution of arſenic in water.**

Eight parts of diſtilled water diſſolve, by means of moderate heat, one part of calcined arſenic, and by boiling may be made to take up 15. The ſolution changes ſyrup of violet green, but the tincture of turnſole red. It is not changed by neutral ſalts, but ſlowly precipitates the ſolutions of metals, the arſenic united to the metallic calx falling to the bottom.—"It may be aſked (ſays Mr Bergman), whether the whole of the arſenic, or only the arſenical acid, unites with the metallic calx, yielding the phlogiſton to the menſtruum of the other metal?" Certainly ſuch a mutual commutation of principles does not appear improbable, if we conſider only thoſe caſes in which the menſtruum is vitriolic or nitrous acid; but as iron, for example, united with marine acid (which does not attract the phlogiſton of white arſenic), as well as when it is joined to the nitrous acid, is precipitated, it would appear that the whole of the arſenic is united, at leaſt in certain caſes, to the metallic calces.

1270 And in ſpirit of wine.

One part of arſenic is diſſolved by 70 or 80 of boiling ſpirit of wine.

1271 In vitriolic acid.

Arſenic diſſolves partially in concentrated vitriolic acid, but concretes in the form of cryſtalline grains on cooling. Theſe diſſolve in water with much greater difficulty than the arſenic itſelf. On the blow-pipe they emit a white ſmoke, but form into a globule by fuſion, which at firſt bubbles, but ſoon grows quiet, and is but ſlowly conſumed even in a white heat. This fixity is occaſioned by the acid carrying off the phlogiſton of the arſenic, and thus leaving a greater proportion of its peculiar acid than what it naturally contains; and therefore the more frequently the operation is repeated, the more fixed the arſenic becomes, though it is ſcarce poſſible to diſſipate the arſenical phlogiſton as perfectly with this acid as with the nitrous; the effects of which have been already particularly mentioned.

1272 In marine acid.

The marine acid, which naturally contains phlogiſton, diſſolves about one-third of its weight of arſenic, a great part of which ſeparates ſpontaneouſly on cooling in a ſtate of ſaturation with the acid. This ſalt, which may be had in a cryſtalline form, is much more volatile than the former, readily ſubliming in a cloſe veſſel with a moderate heat; but is ſoluble with difficulty in boiling water. It is of a fine yellow colour, and ſcarcely differs from butter of arſenic, except in its degree of concentration. The nature of marine acid prevents it from diſengaging the arſenical acid from the phlogiſton of the ſemimetal, as will eaſily appear from what has been ſaid concerning that acid. The arſenical acid, however, is eaſily made to appear by the addition of that of nitre, as will be underſtood from the directions given by Mr Scheele for the preparation of the acid of arſenic.

1273 **Phlogiſticated alkali cannot precipitate arſenic except from marine acid.**

Arſenic is not precipitated from its ſolution in vitriolic and nitrous acids by the phlogiſticated alkali, which yet very readily precipitates all other metals. From the marine acid, however, it is precipitated by its means of a white colour; but unleſs the ſolution be very acid, the addition of mere water will throw down a precipitate of the ſame colour.

1274 Decompoſed by dephlogiſticated marine acid.

Dephlogiſticated marine acid deprives arſenic of its inflammable principle; ſo that in the diſtilling veſſel we find water, acid of arſenic, and marine acid, regenerated.

1275 Phenomena with other acids.

Arſenic is diſſolved by its own acid, and forms cryſtalline grains with it as well as with that of fluor and borax. Saccharine acid diſſolves it likewiſe, and forms priſmatic cryſtals; and a ſimilar ſalt is alſo formed by the acid of tartar. Vinegar, and the acids of vinegar and phoſphorus, form with it cryſtalline grains, which are ſcarcely ſoluble in water.

1276 Liver of arſenic.

Solutions of fixed alkali diſſolve arſenic; and, when loaded with it, form a brown tenacious maſs, called *liver of arſenic*. The arſenic is partly precipitated by mineral acids, though part of it gradually loſes its phlogiſton, and adheres more tenaciouſly. Solution made with volatile alkali ſeems to effect this decompoſition more readily, as no precipitation is made by acids. Limpid ſolution of ſaline hepar, dropped into a ſolution of white arſenic, floats upon the ſurface in form of a grey ſtratum, which at length diſturbs the whole liquor.

1277 Effects on metals.

By the aſſiſtance of heat ſolutions of arſenic attack ſome of the metals, particularly copper, iron, and zinc; the ſolutions of the two laſt yielding cryſtals by evaporation. No alteration is made on theſe compounds by alkaline ſalts or by acids: volatile alkali does not diſcover the copper by changing the colour of the ſolution blue; nor does the phlogiſticated alkali throw down any blue precipitate from the ſolution of iron. The reaſon of this is the ſuperabundance of phlogiſton in the ſolutions; for the arſenical acid takes up all metals: when united with copper, it ſhows a blue colour with volatile alkali; and when united with iron, it lets fall a Pruſſian blue in the uſual way; but the quantity of phlogiſton which converts the acid into white arſenic, prevents the appearance of theſe phenomena when the latter is made uſe of.

1278 Unites eaſily with ſulphur.

1279 Realgar and orpiment.

Arſenic, either in its calcined or reguline ſtate, may be united with ſulphur; in which caſe it appears either of a red or yellow colour, according to the quantity of ſulphur with which it is united. Theſe compounds are ſpontaneouſly produced by nature; both of them ſometimes pellucid and cryſtalline; with this difference, however, that the yellow ſeems to affect a lamellated, and the red a cryſtalline, form. Theſe are called *red and yellow orpiment*, or realgar and orpiment; the ſpecific gravity of realgar being about 3.225; of orpiment, 5.315. Both of theſe ſublime totally with a moderate heat, unleſs when they happen to be mixed with other ſubſtances. They readily unite with thoſe metals which form an union with the arſenic and ſulphur of which they are compoſed. Silver mineralized by fuſion with orpiment, forms a ſubſtance ſimilar to what is called the red ore of that metal. Iron, in conjunction with orpiment, aſſumes a white, poliſhed, and metallic appearance, ſimilar to that of the white or arſenical pyrites; and by various combinations of theſe ſubſtances with metals of different kinds, many of the natural metalline ores may be produced.

1280 Phenomena with nitrous acid.

Nitre, when treated with mineralized arſenic, detonates partly with the ſulphur, and partly with the phlogiſton of the arſenic; the alkaline baſis of the ſalt either forming ſal polychreſt with the acid of the ſulphur, or uniting with the alkali, and forming the neutral arſenical ſalt. By the addition of fixed alkali in proper quantity, either to orpiment or realgar, and then expoſing the mixture to a ſubliming heat, nitre retains the ſulphur, but lets go the greateſt part of the arſenic; the hepatic maſs, however, retains a ſmall quantity of the latter; and if there is much alkali, ſcarce any of the arſenic ariſes.

1281 Butter of arſenic.

On diſtilling orpiment with twice or thrice it quantity of corroſive ſublimate, two liquids ariſe which refuſe to unite; and at length, on augmenting the heat, a cinnabar ariſes. A butter of arſenic is found at the bottom of the receiver, of a ferruginous brown colour, but pellucid: in the open air it firſt ſends forth a copious fume of a white colour, and then gradually attracts the moiſture of the atmoſphere, by which it is precipitated.

1282 Can ſcarce be made to unite with marine acid.

It is remarkable that it unites ſo ſlowly with marine acid, that they ſeem to repel one another; nor can they be made to unite beyond a certain degree. By the affuſion of diſtilled water, a white powder will be precipitated, which, though ever ſo well waſhed, retains ſome acidity; for a portion of butter of antimony is produced by diſtillation, as is likewiſe true of the pulvis algaroth. The ſmoke has a peculiar penetrating ſmell, ſomewhat ſimilar to that of phlogiſticated vitriolic acid, and lets fall white flowers.

1283 Oil of arſenic.

The liquor which ſwims above, and which, by chemical authors, has been compared to oil, is yellowiſh and pellucid, ſeparating a white arſenical powder by the addition of water and ſpirit of wine. It is not affected by the ſtronger acids; but effervesces, and lets fall a precipitate, with alkalies. On keeping it with a cucurbit with a long neck unſtopped, white flowers gradually concrete round the orifice, which are lax, and ſometimes approaching to a cryſtalline form. And laſtly, by ſpontaneous evaporation, pellucid cryſtals appear at the bottom of the liquor, which are ſoluble in water with great difficulty; but when diſſolved, precipitate ſilver from nitrous acid, and let fall ſome arſenic on the addition of an alkali. When put into lime-water, a cloud ſlowly ſurrounds them: on being expoſed to the fire, they totally ſublime without any arſenical ſmell, without decrepitation, or loſing their tranſparency; but if ignited phlogiſtic matter comes in contact with them, the arſenical ſmell inſtantly appears. No traces of mercury are to be found in this liquor by treating it either with alkali or copper; nor the ſlighteſt precipitation is made by it on being dropped into a ſolution of terra ponderoſa in the marine acid: from all which it appears, that this liquor is only a very dilute butter of arſenic, containing leſs of the mercury on account of the quantity of water it has. The butter contains the acid in its moſt concentrated ſtate, and is therefore loaded with a larger quantity of arſenic: the former liquor will therefore be obtained in much larger quantity, by ſetting the mixture of corroſive ſublimate and arſenic to ſtand a night in a cellar, or moiſtened with water, before it be ſubjected to diſtillation. As the common marine acid can diſſolve only a determined quantity of the butter, it naturally follows, that what remains after complete ſaturation ſhould totally refuſe to mix. The acid, however, when too much diluted, precipitates the butter; but in proportion to its ſtrength it diſſolves a greater quantity.

1284 Arſenic mineralized by ſulphur.

Arſenic mineralized by ſulphur is not diſſolved by water, but is affected by the different acids, according to the particular circumſtances of each. Nitrous acid and aqua-regia act moſt powerfully; the former ſoon deſtroys the red colour of the realgar, and converts it into yellow orpiment; its primary action being to calcine the arſenic, without affecting the yellowneſs of the ſulphur. It makes no change on the colour of orpiment. Aqua-regia, by long digeſtion, takes up the arſenic, and leaves the ſulphur at the bottom; and hence we may find out the proportions of the two ingredients. Some dexterity, however, is neceſſary in performing this operation with accuracy; for if, on the one hand, the menſtruum be too weak, part of the arſenic will remain undiſſolved; and if, on the other, it be too ſtrong, part of the ſulphur will be decompoſed; for ſtrong nitrous acid is capable of decompoſing ſulphur by long digeſtion, having a greater attraction for phlogiſton than the vitriolic acid itſelf. The colour of the reſiduum ought to be grey; for as long as any yellow particles remain, it is a ſign that ſome of the arſenic alſo remains. If any iron be preſent in the compound, it is all diſſolved, by reaſon of the ſuperior attraction of the acid for it, before any of the arſenic is taken up, unleſs it ſhall have been calcined either by the acceſs of air and heat employed in the operation, or by the too great power of the menſtruum.

1285 Pure regulus of arſenic, how prepared.

The pure regulus of arſenic may be obtained artificially from white arſenic, either by ſublimation with oil, black flux, or other phlogiſtic materials; or by melting it with double its weight of ſoap and potaſhes; or laſtly, by precipitation by means of ſome other metal, from orpiment or ſandarack melted with ſulphur and fixed alkali. By the firſt of theſe methods it is obtained in a cryſtalline form, octohedral, pyramidal, or even priſmatic.

1286 Miſpickel, a natural regulus of arſenic.

Mr Bergman mentions a natural regulus of arſenic, named *miſpickel*, which along with ſome ſulphur contains a large quantity of iron united with the regulus into a metallic compound; but tho' the iron ſometimes amounts to [illegible] or even [illegible] of the whole, it nevertheleſs remains untouched by the magnet. When ignited, it ſends forth an arſenical ſmell, and ſoon becomes obedient to the magnet, even though the operation be performed on a tile without any additional phlogiſton; it melts eaſily in an open fire, and in cloſe veſſels the greater part of the regulus ſublimes, leaving the iron at the bottom.

1287 Great volatility of this ſemimetal.

The pure regulus of arſenic is vaſtly more volatile than any other metal, and therefore cannot be melted. It begins to ſend forth a viſible ſmoke in 180° of the Swediſh thermometer, and is capable of inflammation; but in order to inflame it, it muſt be thrown into a veſſel previouſly heated to a ſufficient degree, otherwiſe it will be ſublimed. The flame is of an obſcure whitiſh blue, diffuſing a white ſmoke and garlic ſmell. In cloſe veſſels it retains its metallic form, and may be ſublimed of any figure we pleaſe.

1288 Effects of regulus of arſenic on other metals.

Regulus of arſenic unites with many of the metals, but deſtroys the malleability of thoſe with which it enters into fuſion. It renders thoſe more eaſy of fuſion which are melted with difficulty by themſelves; but tin, the moſt eaſily fuſible of all the metals, becomes

comes more refractory by being united with arſenic. This metal acquires a permanent and ſhining whiteneſs by its union with regulus of arſenic, and is able to retain half its own weight of the arſenical metal. The other white metals become grey by fuſion with this ſemimetal, platina only excepted. Gold fuſed in a cloſe veſſel with regulus of arſenic, ſcarcely takes up $\frac{1}{16}$ of its weight; ſilver $\frac{1}{4}$; lead $\frac{1}{4}$; copper $\frac{5}{6}$; and iron more than its own weight. The magnetic property of this laſt metal is deſtroyed by a large quantity of regulus, though the exact proportion which deſtroys it can ſcarcely be determined, as ſome of the iron is always taken up by the ſcoria; but according to Mr Bergman, leſs than an equal quantity is certainly ſufficient. Biſmuth retains $\frac{1}{17}$ of its weight; zinc $\frac{1}{3}$; regulus of antimony $\frac{1}{8}$; and mangaueſe an equal quantity. Nickel and regulus of cobalt take up a large quantity; but how much cannot be determined, as it is next to impoſſible to procure any of thoſe metals in a ſtate of perfect purity. In a ſufficient degree of heat, and by a triture of ſeveral hours, regulus of arſenic takes up about $\frac{1}{6}$ of its own weight of mercury, forming an amalgam of a grey colour.

1289 May be expelled by heat from all the metals with which it is united.

Regulus of arſenic, by reaſon of its volatility, may be expelled from all the metals with which it is united; but, in flying off, it generally carries along with it ſome of the metals with which it is united, gold and ſilver not excepted, if the degree of heat be great and very ſuddenly applied. Platina, however, perfectly reſiſts the volatilization; and by reaſon of its refractory nature, even retains a portion of the arſenic.

1290 Effects of it upon alkaline ſalts and nitre.

This ſemimetal cannot be united by fuſion with alkaline ſalts until the phlogiſton is conſiderably diminiſhed, and the regulus approaches to the nature of pure arſenical acid. By adding regulus therefore to nitre in fuſion, a detonation enſues, the phlogiſton of the former is totally deſtroyed, and the acid uniting with the alkali of the nitre forms a neutral arſenical ſalt, ſimilar to that made with white arſenic and nitre. By diſtillation with dry acid of arſenic, the regulus ſublimes before it can be acted upon by the acid; but when thrown into the acid in fuſion, ſoon takes fire, and ſends forth a white ſmoke: for the acid, being in this inſtance deprived of its phlogiſton, ſeparates that principle from the regulus, and unites with it in ſuch quantity as to regenerate white arſenic; while on the other hand, the regulus, by this operation, is ſo far deprived of its phlogiſton as to appear in the form of a calx.

1291 Decompoſes corroſive ſublimate.

By diſtillation with corroſive ſublimate, a ſmoking butter, and ſmall quantity of mercurius dulcis and running mercury, are procured; which happens in conſequence of a double elective attraction; the regulus of arſenic yielding its phlogiſton to the baſe of the corroſive ſublimate, which being thus really calcined, reduces the former to perfect mercury, while the marine acid takes up the calx of arſenic. The regulus of arſenic readily unites with ſulphur, and forms the ſame red and yellow compounds that have already been mentioned when ſpeaking of white arſenic; it is ſoluble in hepar ſulphuris, but may be precipitated by every other metal which can unite with the hepar.

1292 Converted into white arſenic by the vitriolic acid.

Regulus of arſenic is not affected by the vitriolic acid, unleſs when concentrated and aſſiſted by heat. The inflammable part of the regulus which phlogiſticates the acid flies off, ſo that the remainder aſſumes the nature of white arſenic, and exhibits the ſame properties with menſtrua as any other metallic calx: the ſame holds good with nitrous acid, except that it attracts the phlogiſton more vehemently. Marine acid has little or no effect except when boiling.

1293 Effects of it on metallic ſolution.

Regulus of arſenic precipitates certain metals diſſolved in acids, ſuch as gold and platina, diſſolved in aqua-regia, as well as ſilver and mercury in vitriolic and nitrous acids. Silver generally appears in beautiful poliſhed ſpiculæ, like the arbor Dianæ; but if the arſenic be ſuffered to ſtand long in the nitrous ſolution but little diluted, the ſilver ſpiculæ are again diſſolved, the arſenic in the mean time being dephlogiſticated. Solutions of biſmuth and antimony are ſcarcely rendered turbid. Iron may be ſeparated from regulus of arſenic by digeſtion with marine acid, or with aqua-regia; neither of which will touch the arſenic, as long as any iron remains; but in order to ſucceed in this operation, ſubtile pulveriſation is neceſſary as well as a juſt quantity and ſtrength of the menſtruum. Heat muſt alſo be carefully avoided. The regulus is alſo diſſolved by hepar ſulphuris and by fat oils, the latter forming with it a black maſs like plaſter.

§ 12. *Cobalt.*

Regulus of cobalt, or more properly pure cobalt itſelf (what we have under the name of *cobalt* being only a calx of the regulus), is a ſemimetal of a reddiſh white colour, cloſe-grained, ſo as to be eaſily reducible to powder, about 7.7 of ſpecific gravity, and forming itſelf into maſſes of a needle-like texture, placed upon one another. It is ſeldom or never found native, but almoſt always calcined and united with arſenic, the arſenical acid, ſulphur, iron, &c.

1294 Zaffre, a calx of cobalt.

The zaffre uſed in commerce is an impure and grey calx of cobalt. When mixed with three times its weight of pulveriſed flints, and expoſed to a ſtrong fire, it melts into glaſs of a dark blue colour, called *ſmalt*, uſed in tinging other glaſſes, and in painting.

1295 Smalt, how produced.

With three times its weight of black flux, a ſmall quantity of tallow and marine ſalt, it affords the ſemimetal known by the improper name of *regulus of cobalt*; but the reduction is very difficult.

1296 Regulus of cobalt difficult to reduce.

For this purpoſe a large quantity of flux muſt be made uſe of, and the crucible kept a conſiderable time in a white-red heat, that the matter may become very fluid, and that the ſcoria may be completely fuſed into a blue glaſs, at which period the cobalt ſinks in the form of a button to the bottom.

1297 Properties of cobalt when expoſed to heat.

Cobalt melts in a ſtrong red heat, is very fixed in the fire, and it is uncertain whether it can be volatilized in cloſe veſſels. When ſuffered to cool ſlowly, it cryſtallizes in needle-ſhaped priſms, placed one upon the other, and united in bundles, having a conſiderable reſemblance to maſſes of baſaltes ſeparated from each other: in order to ſucceed in this cryſtallization, however, the cobalt muſt be melted in a crucible till it begins to boil, and, when the ſurface of the metal becomes fixed on being withdrawn from the fire, the veſſel is then to be inclined: that which ſtill remains fluid runs out, and the portion adhering to the lumps formed by the cooling of the ſurface is found covered with cryſtals.

1298 Calcines ſpontaneouſly in the air.

This ſemimetal, expoſed to the atmoſphere, becomes covered with a dull pellicle, and undergoes a ſpontaneous calcination; but it may eaſily be calcined in

1299 Its calx forms a beautiful blue glaſs.

in any quantity by expoſing it in powder in a ſhallow veſſel, under the muffle of a cupeiling furnace, and ſtirring it now and then to expoſe freſh ſurfaces to the air. After being kept red hot for ſome time, this powder loſes its ſplendor, increaſes in weight, and becomes black, the calx being convertible, by a moſt violent heat, into a blue glaſs. By fuſion it combines with vitrifiable earths, forming with them a beautiful bule glaſs extremely fixed in the fire; whence it is of the greateſt uſe in enamel-painting, porcelain-painting, &c. The action of terra ponderoſa, magneſia, and lime, on cobalt, is not known. Alkalies manifeſtly alter it; but in what reſpect is not known.

1300 Phenomena with vitriolic acid.

Cobalt diſſolves in concentrated vitriolic acid, when aſſiſted by a boiling heat; the acid evaporating almoſt entirely in the form of ſulphureons gas. The reſiduum is then to be waſhed; a portion of it diſſolves in the water, and communicates a greeniſh colour to it when warm, which changes to a roſe colour when cold. M. Beaumé affirms, that by ſufficiently evaporating the vitriolic ſolution of cobalt, two ſorts of cryſtals are obtained; one white, ſmall, and cubical; the other greeniſh, quadrangular, ſix lines in length, and four in breadth. Theſe laſt he only conſiders as the true vitriol of cobalt; the former being produced by certain foreign matters united to it. The cryſtals moſt commonly obtained have the form of ſmall needles, and may be decompoſed by fire, leaving a calx of cobalt not reducible by itſelf. They may likewiſe be decompoſed by all the alkalies, by terra ponderoſa, magneſia, and lime. According to Fourcroy, 100 grains of cobalt, diſſolved in the vitriolic acid, afford, by precipitation with pure mineral alkali, 140 grains of precipitate; by the ſame alkali aërated, 160 grains. Diluted vitriolic acid acts on zaffre, and diſſolves a part, with which it forms the ſalt already deſcribed.

1301 With nitrous acid.

Nitrous acid acts upon the ſemimetal with that violence which is its general characteriſtic; and the ſolution, when nearly ſaturated, appears either of a roſy brown or bright green colour. By ſtrong evaporation it yields a ſalt in ſmall needles joined together; which is very deliqueſcent, boils upon hot coals without detonation, and leaves a calx of a deep red colour. It is decompoſed by the ſame ſubſtances as the former, and by exceſs of alkali the precipitate diſappears.

1302 With marine acid.

Muriatic acid, aſſiſted by heat, diſſolves cobalt in part, but has no effect upon it in the cold. It acts more ſtrongly on zaffre, forming a ſolution of a reddiſh brown, which becomes green by being heated. By evaporation it yields a very deliqueſcent ſalt in ſmall needles, which becomes green when heated, and is ſoon after decompoſed. Aqua-regia diſſolves the metal more eaſily than the marine acid, but leſs ſo than the nitrous. The ſolution has been long known as a *ſympathetic Ink.*

1303 With the acid of borax.

Cobalt is not diſſolved directly by the acid of borax; but when a ſolution of this ſalt is mixed with a ſolution of cobalt in any of the mineral acids, a double decompoſition takes place; the alkaline baſis of the borax uniting with the acid which held the cobalt in ſolution; and the calx, combining with the ſedative ſalt, falls to the bottom in form of an inſoluble precipitate.

This ſemimetal is calcined by being heated to ignition with nitre. One part of cobalt, and two or three of dry nitre, well powdered and mixed, when thrown into a red-hot crucible; produce ſmall ſcintillations; a portion of the cobalt being converted into a calx of a red colour, more or leſs deep, and ſometimes of a green.

1304 With ſal ammoniac.

Sal ammoniac is not decompoſed, by reaſon of the little attraction there is between the metal and muriatic acid. M. Bucquet, who made the experiment with great care, could not obtain a particle of volatile alkali.

1305 With ſulphur.

Sulphur does not unite with it but very difficultly, and the combination is promoted by liver of ſulphur. Thus a kind of artificial one may be produced, the grain of which will be finer or cloſer, and its colour whiter or yellower, in proportion to the quantity of ſulphur in the mixture. M. Beaumé obſerves, that this compound cannot be decompoſed by acids, and that fire cannot deſtroy all the ſulphur.

§ 13. *NICKEL.*

1306 Diſcovered by Mr Cronſtedt.

THIS was firſt diſcovered to be a ſemimetal of a peculiar kind by Cronſtedt, in the years 1751 and 1754, who procured it in the form of regulus from its ore, but without being able to reduce it to a ſufficient degree of purity; which indeed has not yet been done by any chemiſt. M. Bergman has laboured moſt in this way, though even he has not reduced it to the purity of other metallic ſubſtances. His experiments were made with ſome regulus made by M. Cronſtedt, and whoſe ſpecific gravity was to that of water exactly as 7.421 to 1. His attempts to purify it were made,

1. By Calcination and Scorification.

1307 Effects of calcination with a violent heat.

Nine ounces of powdered nickel were expoſed for ſix hours, in ſeveral portions, to a moſt violent heat, under the dome of an aſſay furnace. Thus the arſenic was firſt diſſipated with a fetid ſmell, after which the odour of ſulphur became perceptible; after this a white ſmoke aroſe without any ſmell of garlic, and which, according to our author, aroſe probably from the more dephlogiſticated part of the arſenic which now began to ſublime. The heaps (we ſuppoſe after the matter had been poured out of the diſhes, and yet retaining a great deal of heat), when hot, began to ſwell, and green vegetations aroſe from all the ſurface, reſembling ſome kinds of moſs, or the filiform lichen; a ferruginous aſh-coloured powder remained at bottom; and 0.13 of the whole were diſſipated during the operation. Half an ounce of this calx fuſed in a forge for four minutes, along with three times its weight of black flux, yielded a regulus reticulated on the ſurface; the areola of a hexangular figure, with very ſlender ſtriæ, diverging from a centre, full of little tubercles; it weighed 0.73 of half an ounce; was obedient to the magnet; and, when ſcorified with borax, left a blackiſh glaſs.

By a ſecond roaſting the regulus again emitted a garlic ſmell; afterwards a viſible fume without any ſmell, with vegetations as before. The roaſted powder, reduced with black flux as before, ſtill emitted a ſmell of arſenic; but on repeating the fuſion with the calx and borax, nothing but ſome obſcure ſigns of cobalt appeared. A third calcination ſeemed to have much diſſipated the arſenic, as it now emitted but little of that kind of ſmell; the vegetations were alſo gone; and the matter had rather a ferruginous than a green colour. Nearly the ſame phenomenon appeared after reduction in a fourth operation.

On performing the reduction with lime and borax, the regulus, when firſt melted, loſt much of its ferruginous matter, which adhered to the black ſcoriæ; it ſoon acquired an hyacinthine colour, without any remarkable mixture of cobalt, was little obedient to the magnet, and its ſpecific gravity was ſomewhat diminiſhed, being now only 7.0828.

By a fifth calcination, gradually adding a quantity of powdered charcoal while the matter continued red hot, a prodigious quantity of arſenic, imperceptible before, flew off in the form of vapour; the arſenical acid being thus furniſhed with as much phlogiſton as was neceſſary to make it riſe in fume. The regulus was treated in this manner until no more arſenical ſmoke could be perceived; it was now of a lamellated and tenacious texture when reduced, but ſtill diffuſed the arſenical odour on being removed from the fire. The roaſting was therefore repeated a ſixth time, and continued for ten hours; the addition of powdered charcoal continued to diſſipate the arſenic in inviſible vapours which yet were perceptible by the ſmell; the colour of the metallic calx was obſcurely ferruginous, with a mixture of green ſcarcely viſible. On reducing the regulus with equal parts of white flux, lime and borax, a ſemiductile regulus was obtained, highly magnetic, and ſoluble in nitrous acid, to which it communicates a deep green colour; a blackiſh maſs remained, which afterwards become white, and when laid on a burning coal, flies off without any remarkable arſenical ſmell. The regulus being then ſix times fuſed with lime and borax, the ſcoriæ reſembled the hyacinth in colour, and the metallic part was ſurrounded with a green calx. The regulus, as before, was magnetic and ſemi-malleable. Laſtly, it was expoſed for 14 hours to a very ſtrong heat; when the powdered charcoal was added by degrees without any diſſipation of arſenic or loſs of weight; the colour of the roaſted powder was ferruginous, with a very ſlight tinge of green. On reduction, a very ſmall globe, ſtill magnetic, was found among the ſcoriæ.

II. By Sulphur.

1308 Effects of ſulphur and borax.

Eight hundred parts of Cronſtedt's regulus of nickel, fuſed with ſulphur and a ſmall quantity of borax, yielded a mineralized maſs of a reddiſh yellow, whoſe weight amounted to 1700. On expoſing one half of this to the fire, it began to grow black; on which the heat was augmented until vegetations appeared; the remaining calx weighed 652. Melting this part with borax, and the other which had not been expoſed to the fire, a ſulphurated regulus of a whitiſh yellow colour was obtained, weighing 1102. The ſame regulus, calcined for four hours, was firſt covered with vegetations, and then, on the addition of powdered charcoal, diffuſed an arſenical odour; the metallic calx was green, and weighed 1038. A whitiſh yellow regulus was obtained ſemiductile, highly magnetic, and extremely refractory, weighing 594. By fuſion with ſulphur a ſecond time, it weighed 816; one half of which roaſted to greenneſs, united by means of fire to the other half ſtill ſulphurated, weighed 509, and was almoſt deprived of its magnetic quality. A calcination of four hours, during which phlogiſton was added, diſſipated a conſiderable quantity of arſenic; the powder put on an aſh-colour, ſomewhat greeniſh, was in weight 569; and by reduction yielded a regulus whoſe ſurface was red, and which, on breaking, appeared of a white aſh-colour, very friable, and weighing 432; the ſpecific gravity 7.173.

On mineralizing the regulus a third time with ſulphur, adding charcoal as long as any veſtige of arſenic remained, which required a violent calcination of 12 hours, the remaining powder was of an aſh-green colour, and weighed 364; but the regulus obtained by means of a reduction effected by the moſt violent heat in a forge for three quarters of an hour, was ſo refractory that it only adhered imperfectly to the ſcoria, which were of a diſtinct hyacinthine colour; nor could it be reduced to a globule by means of borax, though urged by the ſame vehemence of fire. The abſolute gravity of this regulus was 180; its ſpecific gravity 8.666. Its magnetic virtue was very remarkable; for it not only adhered ſtrongly to the magnet, but to any other piece of iron; and the ſmall pieces of it attracted one another. It had a conſiderable ductility, was of a whitiſh colour, mixed with a kind of glittering red; diſſolved in volatile alkali, yielding a blue ſolution, and a green one in nitrous acid.

An hundred parts of the ſame regulus, beaten out into thin plates, were covered by a calcination of four hours, with a cruſt apparently martial, having under it a green powder, and within it a nucleus conſiſting of reguline particles ſtill unchanged; the weight being increaſed by 5. The friable matter, reduced to powder, put on a browniſh-green colour; and after a calcination of four hours more, concreted at the bottom in form of a friable black cruſt, ſtrongly magnetic, and weighing 100: No veſtiges of arſenic were diſcovered by a ſucceeding operation, in which charcoal was added; nor was the magnetic powder deſtroyed, but the weight was increaſed to 105, and the colour ſomewhat changed. By fuſion for an hour with lime and borax, this powder yielded a regulus of an angular ſtructure, red, ſemiductile, and altogether magnetic; the ſpecific gravity being 8.875. The ſame globule diſſolved in aqua-regia, was precipitated by green vitriol, as if it had been loaded with gold; but the precipitate was readily ſoluble in nitrous acid. Moſt of the reguli ſhowed no ſigns of precipitation with green vitriol.

III. With Hepar Sulphuris.

1309 Effect of hepar ſulphuris.

Fifty-eight parts of regulus of nickel, which had been ſulphurated before, being fuſed with 1800 parts of ſaline hepar ſulphuris, then diſſolved in warm water, filtered through paper, and precipitated by an acid, yielded a powder, which, by calcination till the ſulphur was driven off, appeared of an aſh-colour, and weighed 35. The inſoluble reſiduum, deprived of its ſulphur by means of fire, was likewiſe of an aſh-colour, and weighed 334. On reducing this regulus by means of the black flux, a friable regulus was obtained, which had a very weak magnetic property; but, on fuſion with borax, this quality was augmented. On mixing and melting together equal parts of calx of nickel, gypſum, colophony, and white flux, a powdery, ſquamous, and reguline maſs was produced; which, by fuſion with borax, afforded a regulus poſſeſſing the properties of nickel, but not entirely deſtitute of cobalt, which obeyed the magnet, and did not part with its iron even after two ſolutions in the nitrous acid, and various reductions by fuſion with borax; the ſulphur was alſo retained with great obſtinacy.

On diſſolving regulus of nickel by fuſion, in hepar ſulphuris made with fixed alkali, adding a quantity of nitre ſufficient only to deſtroy a ſmall part of the hepar, the regulus which had been ſuſpended by it was ſeparated, and fell to the bottom. On examining this regulus, it appeared more pure, and generally deprived of cobalt, but ſtill containing iron. In like manner nickel is always very diſtinctly precipitated by regulus of cobalt, as this latter is attracted more powerfully by the hepar ſulphuris. When diſſolved by fuſion with hepar ſulphuris, this ſemimetal may be precipitated by adding iron, copper, tin, or lead, and even by cobalt: the regulus obtained is indeed ſcarcely ever attracted by the magnet; but we are not from thence to conclude that it does not contain any iron; for when the heterogeneous matters, which impede its action, are properly removed, it then acknowledges the power of the magnet very plainly.

IV. By Nitre.

1310 Of nitre.

One part of Cronſtedt's regulus was added to twelve of nitre ignited in a crucible, and kept red-hot for about an hour. Some weak flaſhes appeared firſt; then a large quantity of arſenic was emitted; and, laſtly, the ſides were covered with a blue cruſt occaſioned by the cobalt, a green matter remaining at bottom. This, fuſed again for an hour, with twelve parts of nitre, tinged the internal ſides of the veſſel of a green colour; and, laſtly, a browniſh green maſs, much leſs in quantity than in the former operation, was left at the bottom. This green matter, treated in the ſame way for two hours a third time, left a grey ſcoria at the bottom, which yielded no regulus with black flux.

Another portion of the ſame regulus, treated in the ſame way with nitre, was diſſolved, and became green; yet on being freed by ablution from the alkaline ſalt, it yielded no regulus with black flux, but only ſcoria of an hyacinthine colour mixed with blue, tinging nitrous acid of a green colour, concreting into a jelly, and on evaporation leaving a greeniſh calx behind.

Another portion of Cronſtedt's regulus was kept ſome hours in the crucible with 16 parts of nitre; by which means all the arſenic was firſt ſeparated; then the phlogiſticated nitrous acid; and, laſtly, the ſides of the veſſel were penetrated by a kind of green effloreſcences. The maſs, after being waſhed with water, was of a dilute green colour, and tinged borax of a greeniſh brown. A green powder was ſtill yielded, after treating this in the ſame manner with 12 parts of nitre; and on reducing it with one-half black flux, one-eighth borax, and as much lime, a yellowiſh white regulus, both magnetic and malleable, was obtained, poſſeſſing all the properties of nickel. Its ſpecific gravity was 9.000; the phlogiſtic ingredient was uſed in ſmall quantity, that the iron might, if poſſible, enter the ſcoria.

1311 Nitre capable of ſeparating all the cobalt from nickel.

It having appeared from this and ſome other experiments, that nitre was capable of diſcovering the ſmalleſt quantity of cobalt contained in nickel the products of the former operations were now ſubjected to its action. The regulus produced by repeated ſcorification thus became a little blue; that diſſolved in volatile alkali (to be afterwards particularly mentioned) diſcovered a conſiderable quantity of cobalt; nor was there any one which did not thus diſcover more or leſs of that ingredient by this trial.

V. By Sal Ammoniac.

1312 Effect of ſal ammoniac

A calx of nickel, ſo much freed from cobalt that it did not tinge borax in the leaſt, mixed with twice its weight of ſal ammoniac, yielded by ſublimation with a ſtrong red heat, two kinds of flowers; one, which roſe higher than the other, was of an aſh colour; the other white. The bottom of the glaſs was ſtained of a deep hyacinthine colour; the reſiduum was divided into two ſtrata; the upper one yellow, ſcaly, and ſhining like moſaic gold. With borax it afforded an hyacinthine glaſs, but not regulus; and in a few days liquefied in the air, acquiring a green colour and the conſiſtence of butter. The reſiduum ſhowed the ſame properties with calx of nickel; and the green ſolution ſhowed no veſtiges of iron with galls, but became blue with volatile alkali; which was alſo the caſe with the flowers. The lower ſtratum contained a calx, blackiſh on the upper part, but of a ferruginous brown in the under, with a friable and ſcarcely magnetic regulus, of a reddiſh white. The blackiſh calx yielded an hyacinthine glaſs with borax. Part of this ſtratum ſublimed with twice its quantity of ſal ammoniac; and with the ſame degree of heat as before, yielded flowers of a very fine white, with a reſiduum of ferruginous brown, greeniſh on the upper part towards the ſides of the veſſel, the bottom being ſtained of an hyacinthine colour as before. Twenty parts of ſal ammoniac being added to a part of the inferior ſtratum reduced, the whole was ſublimed in a retort; a blackiſh powder remained, which became green by calcination, and of an hyacinthine colour by ſcorification, as did alſo the bottom of the containing veſſel. The ſublimation being twice repeated, uſing a double quantity of ſal ammoniac each time, the calx became at length very green, diſſolving with the ſame colour in the nitrous acid, and yielding by reduction a white, brittle, and very little magnetic regulus. In all theſe ſublimations, it was obſerved, that the volatile alkali roſe firſt; then ſal ammoniac; and, laſtly, a part of the marine acid was forced over by the violence of the heat.

VI. With Nitrous acid.

1313 Effects of antimony.

Having obtained a ſalt by cryſtallization from nickel diſſolved in nitrous acid, part of this was calcined with charcoal duſt in a proper veſſel, and during the operation a large quantity of arſenic was diſſipated; a grey, ſemiductile, and magnetic regulus being obtained after reduction. A brittle regulus was obtained after a ſecond ſolution, precipitation, and reduction; but by a third operation it became again ſemiductile and magnetic. By repeating this proceſs a fourth and fifth time, the quantity became ſo much diminiſhed that it could no longer be tried. In all theſe ſolutions a blackiſh reſiduum appeared; which, when ſuffered to remain in the acid, grew white by degrees; but when edulcorated and laid on a burning coal, exhaled a ſulphureous ſmoke, and left a black powder ſoluble in the nitrous acid.

VII. By volatile Alkali.

1314 Volatile alkali.

Four hundred and eighty-ſeven parts of a calx of nickel, produced by diſſolving Cronſtedt's regulus in nitrous acid, and precipitating the ſolution by a fixed alkali, being immerſed for 24 hours in a quantity of volatile alkali, yielded a reſiduum of fifty, having a blackiſh green colour. The ſolution, which was blue, by filtration and inſpiſſation yielded a powder of a light blue colour, weighing 282; which, reduced with black flux, produced a white, ſemiductile, and highly magnetic regulus, weighing 35, whoſe ſpecific gravity was 7.000. The ſcoriæ were of a light red: but when mixed with borax, put on an hyacinthine colour, and yielded a regulus weighing 30. The two reguli united together proved very refractory; ſo that the maſs could not be melted by the blow-pipe, even with the addition of borax. It ſent forth neither an arſenical nor ſulphureous ſmell on the addition of charcoal-duſt; but, on a ſucceeding reduction, yielded hyacinthine ſcoriæ; and the remaining flocculi, diſſolved in nitrous acid, affording a very green ſolution, which, on the addition of volatile alkali, yielded a powder of the ſame colour.

From 50 parts of the blackiſh green reſiduum, 13 of a clear white, brittle, ſquamous, and little magnetic regulus, were obtained, the ſpecific gravity of which was 9.333. At the bottom of the veſſel was found a ſcoria of an obſcurely blue colour, with the upper part hyacinthine. It was eaſily fuſed; and tinged borax, firſt blue, then of a hyacinth colour, upon which it became more ſtrongly magnetic. By the aſſiſtance of heat it diſſolved in nitrous acid, forming a ſolution of a beautiful blue colour. A black powder at firſt floated in the liquor, but became white, and fell to the bottom. After edulcoration it was for the moſt part diſſipated, with a ſulphureous ſmell, on being expoſed to the fire; a little brown-coloured maſs, ſoluble in volatile alkali, remaining at bottom. This ſolution was precipitated by phlogiſticated alkali, and a powder thrown down of the colour of calx of nickel, which ſoon grew blue with volatile alkali.

1315 Nickel cannot be obtained in a ſtate of purity.

From all theſe experiments it appears, that nickel cannot be obtained in a ſtate of purity by any means hitherto known. From every other ſubſtance, indeed, it may be ſeparated, except iron; but this reſiſts all the operations hitherto deſcribed, and cannot be diminiſhed beyond certain limits. The magnet not only readily diſcovers its preſence, but ſome portions of the regulus itſelf becomes magnetic; but the tenacity and difficulty of fuſion, which increaſe the more in proportion to the number of operations, plainly ſhow that there is no hope of ſeparating the whole quantity, unleſs we ſuppoſe the regulus of nickel itſelf to be attracted by the magnet; and there is certainly a poſſibility that one other ſubſtance beſides iron may be attracted by the magnet. The great difficulty, or rather impoſſibility, of obtaining it in a ſtate of purity, naturally raiſes a ſuſpicion of its not being a diſtinct ſemimetal, but a mixture of others blended together; and on this ſubject our author agrees in opinion with thoſe who ſuppoſe it to be a compound of other metals. Indeed, Mr Bergman is of opinion, that "nickel, cobalt, and mangaueſe, are perhaps no other than modifications of iron." And in order to aſcertain this, he made the following experiments.

1316 Bergman's opinion of the compoſition of nickel.

1317 Experiments to compoſe nickel artificially.

1. Equal parts of copper, of the gravity of 9.3243, and iron of 8.3678, united by fuſion with black flux, yielded a red maſs, whoſe ſpecific gravity was 8.5441; and which tinged nitrous acid firſt blue, then green, afterwards yellow, and at laſt of an opaque brown. 2. Two parts of copper and one of iron had a ſpecific gravity of 8.4634; the mixture yielding firſt a blue, and then a green ſolution. 3. Equal parts of copper and iron, of the ſpecific gravities already mentioned, with another part of cobalt whoſe gravity was 8.1500, yielded a metal of the gravity of 8.0300, imparting a brown colour to the ſolution. 4. Two parts of arſenic of 4.000, added to one of copper and another of iron, gave a brittle metal of 8.0468, which formed a blue ſolution. 5. One part of copper, one of iron, two of cobalt, and two of white arſenic, gave a brittle regulus of 8.4186; the ſolution of which was browniſh, and ſeparated in part ſpontaneouſly. 6. One part of copper, one of iron, four of cobalt, and two of white arſenic, formed a maſs of 8.5714. The ſolution was ſomewhat more red than the former; and a ſimilar effect took place on repeating the experiment, only that the ſpecific gravity of the metal was now 8.2941. 8. One part of iron and four of white arſenic formed a metal which diſſolved with a yellow colour; and, on the addition of Pruſſian alkali, immediately let fall a blue ſediment. 9. One part of copper, eight of iron, ſixteen of white arſenic, and four of ſulphur, united by fire, on the addition of black flux, yielded a maſs which, though frequently calcined and reduced, produced nothing but brown or ferruginous calces. It acquired a greenneſs with nitrous acid; but on the addition of phlogiſticated alkali depoſited a Pruſſian blue. 10. One part of iron was diſſolved in ſix of the nitrous acid, and likewiſe ſeparated by one part of copper and one of the calcined ore of cobalt, in the ſame quantity of the ſame acid. The whole of the ſolution of iron was then mixed with five parts of the ſolution of copper, whence a green and ſaturated nickel colour was produced; which, however, on the addition of three parts of the ſolution of cobalt, became evidently obſcured. The alkaline lixivium dropped into this threw down at firſt a ferruginous brown ſediment, the ſolution ſtill remaining green: afterwards all the blue was precipitated; by which at firſt all colour was deſtroyed, but afterwards a red appeared, occaſioned by the cobalt diſſolved in the alkaline ſalt. The ſediment, when reduced, yielded a regulus ſimilar to copper, and at the ſame time ductile, which tinged both glaſs and nitrous acid of a blue colour. If a ſaturated ſolution of nickel be mixed with half its quantity of ſolution of cobalt, the green colour is much obſcured; but four parts of the former, on the addition of three of the latter, put off all appearances of nickel. See the article NICKEL.

§ 14. *Of PLATINA.*

1318 The heavieſt of all metals.

THE properties of this metal have not as yet been thoroughly inveſtigated by chemiſts, and there is therefore ſome diſagreement concerning them. Formerly it was ſuppoſed to be inferior in ſpecific gravity to

1319
Inſoluble except by dephlogiſticated marine acid.

1320
Found in ſmall grains intermixed with foreign ſubſtances.

gold; but now is generally allowed to be ſuperior in that reſpect by little leſs than a fourth part; being to water in the proportion of 23 to 1 when perfectly freed from all heterogeneous matters. Mr Bergman ſays that its colour is that of the pureſt ſilver. The very ſmall globules of it are extremely malleable; but when many of theſe are collected together, they can ſcarcely be ſo perfectly fuſed as to preſerve the ſame degree of malleability. They are not affected by the magnet in the leaſt, nor can they be diſſolved in any ſimple menſtruum excepting dephlogiſticated marine acid. As it is commonly met with, however, platina has the form of ſmall grains, its plates of a bluiſh black, whoſe colour is intermediate betwixt thoſe of ſilver and iron. Theſe grains are mixed with many foreign ſubſtances, as particles of gold, mercury, and blackiſh ferruginous, ſandy grains, which by the magnifier appear ſcorified. The grains themſelves, when examined by a magnifying glaſs, appear ſometimes regular, ſometimes round and flat, like a kind of button. When beat on the anvil, moſt of them are flattened and appear ductile; ſome break in pieces, and on being narrowly examined appear to be hollow, and particles of iron and a white powder have been found within them: and to theſe we muſt attribute the attraction of platina by the magnet; ſince, as we have already obſerved, pure platina is not attracted by it.

1321
Mr Bergman's experiments on this metal.

Mr Bergman, who carefully examined this metal, diſſolved it firſt in aqua-regia compoſed of the nitrous and marine acid. The ſolution at firſt exhibits a yellow colour, but on approaching to ſaturation became red, and the redneſs increaſes as the liquor becomes more loaded with metal. Cryſtals are produced by evaporation of a deep red colour, generally in ſmall angular and irregular grains, whoſe true ſhape cannot be diſcovered. Their appearance is ſometimes opaque and ſometimes pellucid. After theſe are once formed, they are extremely difficult of ſolution, requiring much more water than even gypſum itſelf for this purpoſe.—The ſolution is not precipitated by vegetable fixed alkali, nor does the latter affect the cryſtals, except very faintly by digeſtion with them in a cauſtic ſtate. Aerated mineral alkali takes them up and grows yellow, but without depoſiting any thing, though it decompoſes them at laſt by evaporating to dryneſs.

1322
Cryſtals of platina may be decompoſed by mineral but not vegetable fixed alkali.

On the addition of a ſmall quantity of vegetable fixed alkali, either mild or cauſtic, ſmall red cryſtals ſoluble in water, and ſometimes of an octohedral figure, are depoſited. They are decompoſed with difficulty by the mineral alkali, but not at all by the vegetable. If a larger quantity of ſalt is added at firſt, an inſoluble ſpongy matter of a yellow colour is precipitated. Cryſtalline particles of the ſame kind are thrown down by an alkali ſaturated either with the vitriolic, nitrous, marine, or acetous acids, though all the platina cannot thus be ſeparated from the menſtruum.

1323
Solution in aqua-regia made with nitrous acid and that of ſea ſalt.

Aqua-regia, compoſed of nitrous acid and common ſalt, diſſolved the metal with equal facility as the former; only the ſolution was more dilute, and a yellow powder floated on the ſurface, a larger quantity being found at the bottom. On adding vegetable fixed alkali to the clear ſolution, a copious yellow powder, ſoluble in a large quantity of water, was depoſited. A powder, of a ſimilar kind, was precipitated, tho' more ſlowly, and more of a cryſtalline nature; but mineral alkali, though uſed in much larger quantity, did not make any alteration. The collected powder was yellow, and agreed in property with that ſeparated ſpontaneouſly in a former experiment.

1324
In a liquor compoſed of nitre and ſpirit of ſalt.

On repeating the experiment with nitre and depurated ſpirit of ſalt, inſtead of nitrous acid and ſea-ſalt, the platina was diſſolved into gold-coloured liquor, a greeniſh coloured granulated matter falling to the bottom, and the finer part of the ſame riſing to the top. After ſaturating the ſuperfluous acid, a metallic calx, inſoluble in water, was thrown down by the vegetable alkali. The green powder is ſoluble in water, and is of the ſame nature with the precipitate thrown down by the vegetable alkali.

1325
Cryſtalline powder precipitated by vegetable alkali from ſolution of the calx in marine acid;

1326
But not from the ſolution in nitrous acid.

Platina precipitated from aqua-regia by a ſufficient quantity of mineral alkali, the precipitate waſhed and diſſolved in marine acid, on the addition of vegetable alkali immediately lets fall a cryſtalline powder, as it does alſo with nitre and other ſalts, having the vegetable alkali for their baſis. The caſe is the ſame with calx of platina, diſſolved in vitriolic acid. Nitrous acid alſo diſſolves the calx of platina, but does not yield any diſtinct ſaline precipitate without the aſſiſtance of marine acid.—The above phenomena are likewiſe produced by the precipitate thrown down by the vegetable alkali after the ſaline powder has been depoſited.

1327
This precipitate a kind of triple ſalt.

From theſe experiments our author concludes, 1. That the precipitate which is firſt thrown down, on the addition of vegetable alkali to ſolutions of platina, is a ſaline ſubſtance, and different from the calx of the metal. 2. That this ſaline precipitate is compoſed of calcined platina, marine acid, and vegetable alkali. 3. By means of vitriolic acid, a precipitate analogous to this may be obtained, compoſed of calcined platina, vegetable alkali, and vitriolic acid. 4. The whole ſolution of platina cannot be precipitated by vegetable alkali in form of a triple ſalt; but after paſſing a certain limit, a metallic calx in the uſual way is produced.

1328
Whether mineral alkali can ſeparate platina from its ſolvent.

1329
Fifty-ſix times as much mineral alkali required to precipitate platina as of vegetable alkali.

As it has been denied by Margraaf and Lewis that mineral alkali is capable of ſeparating platina from its acid, our author was induced to attend particularly to this circumſtance. Having therefore tried the common ſolution with mineral alkali, he found that each drop excited a violent efferveſcence, and at laſt that a yellow ſpongy matter, affording a genuine calx of platina, was precipitated: this was more ſpeedily effected by uſing the dry mineral alkali, which had fallen to powder of itſelf. To determine, however, the difference betwixt the two alkalies in a more accurate manner, he divided a very acid ſolution of platina into two equal parts. To one of theſe, he added ſmall portions of the vegetable, and to the other an equal weight of pieces of mineral alkali, waiting five minutes after every addition, till the efferveſcence ſhould fully ceaſe. After the firſt addition, ſmall cryſtals appeared; in the former partly on the ſurface, and partly in the bottom; but in the latter no precipitate could be obſerved until 56 times the quantity of vegetable alkali had been added. The difference, however, was even greater than what appears from this experiment; for the vegetable alkali was cryſtallized, and therefore charged with the water neceſſary to its cryſtalline form; whereas the mineral alkali was ſpontaneouſly calcined: and though, in equal quantities of theſe two alkalies, the purely alkaline parts are as 3 to 2, yet three parts of vegetable alkali ſaturated only 1.71 of this aqua-regia, while two of the mineral alkali took up about 2.6.

1330 Effects of the volatile alkali.

The volatile alkali firſt throws down this metal in a ſaline form; the grains ſometimes diſtinctly octohedral. Their colour is red when that of the ſolution is ſo, but yellow when the ſolution is more dilute. After ſaturating the ſuperabundant acid, the ſame alkali precipitates the platina truly calcined. This precipitate is diſſolved in water, though with difficulty, and may be reduced to more regular cryſtals by evaporation. Theſe are diſſolved by the mineral alkali; but hardly any ſigns of decompoſition are to be obſerved, unleſs the yellow ſolution, evaporated to dryneſs, be again diſſolved in water; for then the metallic calx reſts at the bottom, and the ſolution is deprived of its yellow colour. The vegetable alkali has ſcarce any effect in this way; for, after repeated exſiccation, the ſolution remains clear and yellow: but here probably the fixed alkali takes the place of the volatile; for in larger quantities, and eſpecially when the cauſtic vegetable alkali is made uſe of, the mixture ſmells of volatile alkali.

1331 Platina partly precipitated by neutral ſalts.

The volatile alkali, ſaturated with any acid, precipitates the platina in the ſame manner as the vegetable alkali in combination with acids: but theſe neutral ſalts precipitate only a determined quantity of platina; for after their effect has ceaſed, the liquor lets fall a pure calx of platina on the addition of vegetable or volatile alkali.

1332 Triple ſalts formed by this metal.

The calx of platina precipitated by mineral alkali, and then diſſolved in any ſimple acid, ſhows nearly the ſame phenomena with volatile alkali as with the vegetable alkali. "Whence (ſays Mr Bergman) we may conclude, that platina diſſolved in acids forms at firſt, both with the volatile and fixed vegetable alkali, a triple ſalt, difficult of ſolution, and which therefore almoſt always falls to the bottom unleſs the quantity of water be very large." Calcareous earth, whether aerated or cauſtic, produces the ſame phenomena as the mineral alkali, without any cryſtalline appearance.

1333 Platina the moſt infuſible ſubſtance in the world.

1334 Firſt melted by a burning mirror.

Platina has been remarkable ever ſince its firſt diſcovery for being the moſt infuſible ſubſtance in the world. Meſſrs Macquer and Beaumé kept it in the moſt violent heat of a glaſs-houſe furnace for ſeveral days without perceiving any other alteration than that its grains adhered ſlightly to each other; but the adheſion was ſo ſlight that they ſeparated even by touching. In theſe experiments the colour of the platina became brilliant by a white heat, but acquired a dull grey colour after it had been heated for a long time. They obſerved alſo, that its weight was conſtantly increaſed: which undoubtedly aroſe from the calcination of the iron it contained. Dr. Lewis, after various attempts to fuſe platina, found himſelf unable to ſucceed even in a fire which vitrified bits of glaſs-houſe pots and Heſſian crucibles. Meſſrs Macquer and Beaumé firſt melted this refractory metal with a large burning-glaſs, 22 inches diameter and 28 inches focus. The power of this ſpeculum was almoſt incredible, and far exceeded what is related of the lens of Tſchirnhauſen or the mirror of Villette. Its general effects are related under the articl *Burning-Glaſs*. And as platina reſiſted this intenſe heat more than ſix times as long as the moſt unfuſible ſubſtances formerly known, it appears to require a fire as many times ſtronger to melt it. It has been found, however, capable not only of fuſion but of vitrification by the electric fire; and that it may alſo be melted by fire excited by dephlogiſticated air: but M. de Liſle was the firſt who was able to melt it with the heat of a common forge when expoſed to the blaſt of a double bellows in a double crucible. Thus its real ſpecific gravity began firſt to be known. It muſt be obſerved, however, that this fuſion was not performed on common platina, but on ſuch as had been diſſolved in aqua-regia and precipitated by means of ſal ammoniac. M. Morveau repeated the experiment, and from 72 grains of platina obtained a regulus weighing 50¼; which ſeemed to have undergone a very imperfect fuſion; for it did not adhere to the crucible or take its form, but ſeemed to be merely platina revived. Its ſpecific gravity was alſo found to be no more than 10.045; but it was nearly as malleable as ſilver; and when it had been ſufficiently hammered, its ſpecific gravity was augmented to no leſs than 20.170, which is more than that of gold itſelf. M. Morveau found that he could melt the precipitate with different fluxes, ſuch as a mixture of white glaſs, borax, and charcoal, and a mixture of white glaſs and neutral arſenical ſalt: and that the regulus thus obtained was more completely fuſed, but was not malleable, and obeyed the magnet; but the regulus obtained without addition did not ſhow this mark of containing iron. He alſo found, that by means of the abovementioned flux of white glaſs, borax, and charcoal, he could melt crude platina. Since that time the fuſion of platina has been accompliſhed by various chemiſts, and with different fluxes; and in proportion to the degree of purity to which the metal has been reduced, its ſpecific gravity has alſo increaſed; ſo that it is now ſettled at 23, that of fine gold being 19.

1335 May be vitrified by electric fire.

1336 Its precipitate fuſible in a common forge.

1337 This precipitate, or even crude platina, fuſible by the aſſiſtance of fluxes.

1338 Alloyed by Dr Lewis with other metals.

1339 With gold.

Though Dr Lewis could not accompliſh the fuſion of platina by the methods he attempted, he was nevertheleſs able to alloy it with other metals. Equal parts of gold and platina may be melted together by a violent fire, and the mixed metal formed into an ingot by pouring it into a mould. It is whitiſh, hard, and may be broken by a violent blow; but when carefully annealed, is capable of conſiderable extenſion under the hammer. Four parts of gold with one of platina form a compound much more fuſible than the former, and likewiſe more malleable; ſo that it may be extended into very thin plates without being broken or even ſplit at the edges. Dr Lewis remarks alſo, that though in this caſe it be alloyed with ſuch a quantity of white metal, it nevertheleſs appears no paler than guineas uſually are, which contain only one-twelfth of ſilver.

1340 With ſilver.

Equal parts of ſilver and platina melted together with a violent fire, form a much harder and darker-coloured maſs than ſilver, which has alſo a large grain, though it preſerves ſome ductility. Seven parts of ſilver with one of platina form a compound much more reſembling ſilver than the other; but ſtill coarſer-grained and leſs white. From the experiments made on ſilver, however, it appears that no perfect union is formed betwixt the two; for after the mixture has been kept in fuſion for a conſiderable time, moſt of the platina ſeparates and falls to the bottom. Lewis obſerved that ſilver melted with platina was thrown up with an exploſion againſt the ſides of the crucible.

1341
Copper conſiderably improved by union with platina.

Silver did not appear to be in any degree meliorated by its union with this metal, excepting by the ſuperior hardneſs communicated to it; but copper ſeemed to be conſiderably improved. A large proportion of platina, indeed, as two-thirds or equal parts, produced an hard, brittle, and coarſe-grained compound; but when a ſmaller quantity of platina is added, as from $\frac{1}{4}$ to [illegible], or even leſs, a golden-coloured copper is produced, very malleable, harder, ſuſceptible of a finer poliſh, ſmoother-grained, and much leſs ſubject to calcination and ruſt than pure copper.

1342
Unites moſt readily with zinc;

Of all metallic matters, however, zinc moſt readily unites with platina, and is moſt effectually diſſolved by fuſion. When the proportion of platina is conſiderable, the metal is of a bluiſh colour, the grain cloſer, without tarniſhing or changing colour in the air, and they have not even the malleability of the ſemimetal.

1343
And with the compound metals.

Platina unites readily with the compound metals, braſs formed of copper and zinc, and bronze made of copper and tin. In the latter it was remarkable, that the compound metal took up more platina than both its ingredients ſeparately can do. This compound was hard and capable of receiving a fine poliſh, but is ſubject to tarniſh.

1344
The compound of braſs and platina a proper material for ſpeculums.

Equal parts of braſs and platina formed a compound very hard, brittle, capable of receiving a fine poliſh, and not ſubject to tarniſh. It is poſſible therefore that it might be uſed to advantage as a material for ſpeculums; all materials for which, hitherto diſcovered, have the great inconvenience of tarniſhing in the air, and that very quickly.

1345
Can ſcarce be united with mercury.

1346
Mercury leaves platina to unite with gold.

Platina amalgamates with mercury, but with much greater difficulty than gold, which will alſo ſeparate the quickſilver after it has been united with the platina. The amalgamation of platina does not ſucceed but by very long trituration of the metals with water, as for inſtance a week; but if the trituration be performed with a mixed metal compoſed of gold and platina, the mercury ſeizes the gold, and leaves the platina untouched. Dr Lewis propoſes this as a method of ſeparating gold from platina; and it is that uſed in Peru, where gold and platina are ſometimes naturally mixed in the ore; but we do not know whether this ſeparation be quite complete.

1347
May be united with forged and caſt iron;

Mr Morveau ſucceeded in uniting iron with platina, though Dr Lewis could not accompliſh this. The latter ſucceeded, however, in uniting it with caſt iron. The compound was much harder and leſs ſubject to ruſt than pure iron. It was alſo ſuſceptible of a much finer poliſh.

1348
And with tin, lead, or biſmuth.

Platina may be alloyed with tin, lead, or biſmuth, but without any advantage. To lead and tin it gives the property of aſſuming blue, violet, or purple colours, by being expoſed to the atmoſphere.

1349
May be melted by means of arſenic.

Dr Lewis could not ſucceed in uniting platina with arſenic; but M. Scheffer affirms, that if only one twentieth of arſenic be added to platina when red hot in a crucible, the two ſubſtances will be perfectly fuſed and united into a brittle grey maſs. This experiment did not ſucceed with Mr Margraaf; for he, having expoſed to a violent fire during an hour a mixture of an ounce of platina with a fuſible glaſs, compoſed of eight ounces of minium, two ounces of flints, and one ounce of white arſenic, obtained a regulus of platina well united and fuſed, weighing an ounce and 32 grains; the ſurface of which was ſmooth, white, and ſhining, and the internal parts grey; but which nevertheleſs appeared ſufficiently white when filed. The experiment ſucceeded imperfectly alſo in the hands of Dr Lewis; but M. Fourcroy informs us, that "it has ſince been repeated, and that platina is in fact very fuſible with arſenic, but that it remains brittle. In proportion as the arſenic is driven off by the continuance of the heat, the metal becomes more ductile; and by this proceſs it is that M. Achard and M. de Morveau ſucceeded in making crucibles of platina by melting it a ſecond time in moulds." (A)

1350
Fourcroy denies that platina can be united with mercury.

M. Fourcroy ſeems to deny that platina can be united with mercury, contrary to what is mentioned above. "Platina (ſays he) does not unite with mercury, though triturated for ſeveral hours with that metallic fluid. It is likewiſe known, that platina reſiſts the mercury uſed in America to ſeparate the gold. Many intermediums, ſuch as water, uſed by Lewis and Beaumé, and aqua regia by Scheffer, have not been found to facilitate the union of theſe two metals. In this reſpect platina ſeems to reſemble iron, to whoſe colour and hardneſs it likewiſe in ſome meaſure approaches." This laſt ſentence, however, ſeems very little to agree with what he himſelf had before told us of M. Macquer's experiment of melting platina. "The melted portions (ſays he) were of a white brilliant colour, in the form of a button; they could be *cut to pieces* with a knife." This ſurely was a very ſmall approach to the hardneſs of iron; and gives us an idea rather of the conſiſtence of tin or lead. "One of theſe maſſes was flattened on the anvil, and converted into a thin plate without cracking or breaking, but it became hard under the hammer." In another experiment indeed the button of platina was brittle, and ſufficiently hard to make deep traces in gold, copper, and even iron; but this was obtained from precipitated platina urged for 35 minutes by a ſtrong blaſt furnace. In an experiment of this kind M. Beaumé even ſucceeded in melting the precipitate along with certain fluxes, into a vitriform ſubſtance by two different proceſſes. The precipitate of platina, mixed with calcined borax, and a very fuſible white glaſs, was expoſed, for 36 hours, in the hotteſt part of a potter's furnace; and afforded a greeniſh glaſs, inclining to yellow, without globules of reduced metal. This glaſs, treated a ſecond time with cream of tartar, gypſum, and vegetable alkali, was completely melted, and exhibited globules of platina diſperſed through its ſubſtance. M. Beaumé ſeparated them by waſhing, and found them ductile. The ſame chemiſt afterwards, together

1351
Inconſiſtent in his account of its hardneſs.

1352
Precipitated platina vitrified by M. Beaumé

(A) For a particular account of this proceſs ſee before n° 587.

gether with M. Macquer, expoſed precipitate of platina to the ſame burning mirror with which they had fuſed the metal: the precipitate exhaled a very thick and luminous fume, with a ſtrong ſmell of aqua-regia: it loſt its red colour, reſumed that of platina, and melted into a perfect brilliant button, which was found to be an opaque vitreous ſubſtance, of an hyacinthine colour at its ſurface, and blackiſh within; and may be conſidered as a true glaſs of platina. It may however be obſerved, that the ſaline matters with which it was impregnated contributed doubtleſs to its vitrification.

1353
Precipitate by ſal ammoniac fuſible in a ſtrong forge heat.

1354
This fuſion ſuppoſed by Macquer not to be perfect.

"The orange-coloured precipitate obtained by pouring a ſolution of ſal ammoniac into a ſolution of platina, appears to be a ſaline ſubſtance entirely ſoluble in water. This precipitate has a valuable property, diſcovered by M. de l'Iſle, viz. that it is fuſible without addition in a good furnace or common forge-heat. The platina melted by this proceſs is a brilliant, denſe, and cloſe-grained button; but it is not malleable unleſs it has been expoſed to a very ſtrong heat. Macquer thinks that this fuſion, like that of the grains of platina alone, expoſed to the action of a violent fire, conſiſts only in the agglutination of the ſoftened particles; which being exceedingly more divided and minute than the grains of platina, adhere to and touch each other in a greater number of points than the grains; and in that manner render the texture of the metal much more denſe, though no true fuſion may have taken place. It ſeems, however, that if platina in grains be capable of fuſion by the burning glaſs, and of becoming conſiderably ductile, the precipitate of this metal, formed by ſal ammoniac may likewiſe be fuſed on account of its extreme diviſion; and that its not being as ductile as the button of platina fuſed by the ſolar heat, may perhaps depend on its retaining a part of the matter it carried down with it in precipitation, of which it may be poſſible to deprive it by fire."

1355
Attempts to purify platina by cupellation

It being ſo extremely difficult to bring platina itſelf into fuſion, one of the firſt attempts to purify it was by cupellation with lead. Thus the baſer metals would be ſcorified; and, running through the crucible along with the lead, leave the platina in as great purity as though it had been melted by itſelf. This operation, however, was found almoſt equally difficult with the fuſion of the metal by itſelf. Lewis failed in the experiment, though he applied the moſt violent heat of the ordinary cupelling furnaces. The vitrification and abſorption of the lead indeed took place as uſual; but in a ſhort time the platina became fixed, and could not by any means be rendered fluid. Meſſrs Macquer and Beaumé ſucceeded by expoſing an ounce of platina with two ounces of lead in the hotteſt part of a porcelain furnace, where the fire is continued for 50 hours without intermiſſion. At the end of the operation the platina was flattened in the cupel; its upper ſurface was dull and rough, and eaſily ſeparated; but its under ſurface was brilliant, and it was found eaſily to extend under the hammer; and on every chemical trial, was found to be perfectly pure, without any mixture of lead. M. de Morveau likewiſe ſucceeded in cupelling a mixture of one drachm of platina and two drachms of lead in M. Macquer's wind-furnace. The operation laſted eleven or twelve hours, and a button of platina was obtained which did not adhere to the cupel, was uniform, though rather rough, and of a colour reſembling tin. It weighed exactly one drachm, and was not at all acted upon by the magnet. Thus it appears that platina may be obtained in plates or laminæ, which may be forged, and conſequently may be employed in making very valuable utenſils; and this the more eſpecially as Mr Beaumé has obſerved that different pieces of it may be welded and forged like iron. After having heated two pieces of pure cupelled platina to whiteneſs, he placed them one upon the other, and ſtriking them briſkly with a hammer, found that they united together as quickly and firmly as two pieces of iron would have done.

1356
Of the poſſibility of adulterating gold with platina.

The great ſpecific gravity of platina has rendered it a very deſirable matter for ſuch as wiſh to adulterate the precious metal, and can procure the platina eaſily. This, however, can only be done in South America, where platina is met with in plenty. In Europe the ſcarcity of platina renders it a more valuable object than even the gold itſelf. Fears of this fraud, however, have undoubtedly given occaſion to the prohibition of exporting it. There are great differences among chemiſts concerning the quantity of platina that can be mixed with gold without deſtroying the colour of the latter. Dr Lewis, as has already been obſerved, informs us, that four parts of platina may be mixed with one of gold, and yet the mixture be no paler than that for guineas; while Fourcroy aſſerts, that "it greatly alters the colour of the metal, unleſs its quantity be very ſmall: thus, for example, a 47th part of platina, and all the proportions below that, do not greatly affect the colour of the gold." But whether this be the caſe or not, chemiſtry has afforded various ways of ſeparating even the ſmalleſt proportion of platina from gold; ſo that there is now no reaſon to prohibit the importation of it to Europe, more than that of any other metal with which gold can be alloyed. The following are the methods by which the platina may be moſt readily diſcovered: 1. By amalgamating the ſuſpected metal with mercury, and grinding the mixture for a conſiderable time with water; by which the platina will be left, and the gold remain united with the quickſilver. 2. By diſſolving a little of it in aqua-regia, and precipitating with alkaline ſalt; the remaining liquor, in caſe the metal has been adulterated with platina, will be ſo yellow, that it is ſuppoſed a mixture of one thouſandth part would thus be found out. 3. By precipitation with ſal ammoniac, which throws down the platina but not the gold. If mineral alkali be uſed, the gold will be precipitated, but not the platina, unleſs the precipitant is in very large quantity. 4. By precipitation with green vitriol, which throws down the gold, and leaves the platina united with the menſtruum.

1357
Methods of detecting this fraud if it ſhould be practiſed.

1358
Platina moſt eaſily diſcoverable by its great ſpecific gravity.

All theſe methods, however, are not only attended with a conſiderable deal of trouble, but in ſome caſes, for inſtance in ſuſpected coin, it might not be eligible to uſe them. The hydroſtatic balance alone affords a certain method of diſcovering mixtures of metals without hurting the texture of their parts. The great ſpecific gravity of platina would very readily diſcover it if mixed with gold in any moderate quantity; and even in the ſmalleſt, the gravity of the maſs could never be leſs than that of the pureſt gold: which circumſtanc cumſtance alone, as gold is never worked without alloy, would be ſufficient to create a juſt ſuſpicion; after which ſome of the methods already mentioned might be tried. It is poſſible, however, that the hardneſs and ductility of platina might render it more proper for alloying gold than even copper or ſilver, uſually made uſe of for this purpoſe.

§ 15. *Of MANGANESE.*

1359
New ſemimetal afforded by manganeſe.

THIS ſubſtance is now diſcovered to afford a ſemimetal different from all others, and likewiſe to poſſeſs ſome other properties of a very ſingular kind. Mr Scheele has inveſtigated its nature with the utmoſt care; and the reſult of his inquiries are as follows:

1360
Properties of the common manganeſe treated with vitriolic acid.

1. Two drachms of levigated manganeſe, digeſted for ſeveral days in a diluted vitriolic acid, did not appear to be diſſolved or diminiſhed in quantity; nevertheleſs a yellowiſh white precipitate was procured by ſaturating the acid with fixed alkali. The remaining manganeſe was not acted upon by more of the ſame acid, but the addition of another half ounce nearly deſtroyed the acidity of the menſtruum when boiled upon it.

2. With concentrated vitriolic acid an ounce of manganeſe was reduced to a maſs like honey, and then expoſed to the fire in a retort till it became red-hot. Some vitriolic acid came over into the receiver; and after breaking the retort, a maſs was found in it weighing 12¼ drachms, hard and white in the inſide, but red on the outſide. A great part of it diſſolved in diſtilled water, on the affuſion of which at firſt it became very hot. The reſiduum after edulcoration weighed a drachm and an half, and was of a grey colour. Being calcined in a crucible with concentrated vitriolic acid till no more vapours aroſe, it was all diſſolved by water excepting one drachm; which being again calcined with the ſame acid, an inſoluble reſiduum of a white colour, and weighing only half a drachm, remained. This white reſiduum efferveſced with borax, and melted into a tranſparent brown glaſs; it likewiſe efferveſced with fixed alkali, changing into a brown maſs, which yielded an hepatic ſmell with acids, and became at the ſame time gelatinous. The ſolution obtained by calcination was evaporated and ſet to cryſtallize. A few ſmall cryſtals of ſelenite were firſt depoſited, and afterwards ſome very fine large cryſtals of an oblique parallelopiped form, whoſe number increaſed as long as there was any liquid left. They taſted like Epſom ſalt, and Mr Weſtfeld ſuppoſes them to be alum; but according to Mr Scheele, they have no other reſemblance to alum than that they contain the vitriolic acid.

1361
Entirely diſſolved by phlogiſticated vitriolic acid.

3. By phlogiſticated vitriolic acid the manganeſe was entirely diſſolved. To procure this acid in purity, Mr Scheele dipped ſome rags in a ſolution of alkali of tartar, and after ſaturating them with the fumes of burning brimſtone, put them into a retort, pouring on them ſome diſſolved acid of tartar, luting on a receiver which contained levigated manganeſe and water. After a warm digeſtion of only one day, the liquid of the receiver had become as clear as water, and a little fine powder, conſiſting principally of ſiliceous earth, fell to the bottom.

4. Two drachms of levigated manganeſe, digeſted for ſeveral days with an ounce of pure colourleſs acid of nitre, did not appear to have deprived the menſtruum of its acidity, or to have been affected by it in any degree. The liquor being diſtilled off, and the product of the diſtillation poured back on the reſiduum, a ſmall quantity of it was diſſolved. By a third diſtillation, and pouring back the liquor on the reſiduum, a complete ſolution was effected; and this quantity of acid appeared capable of diſſolving nine drachms of the powder.

1362
Precipitate and cryſtals obtained from the ſolution.

5. The ſolution of manganeſe thus ſaturated, was filtered and divided into two equal portions. Into one of theſe ſome drops of vitriolic acid were poured, by which a fine white powder was thrown down, which, however, did not ſettle to the bottom for ſome hours. It was ſoluble neither in boiling water nor in acids. The limpid ſolution, by evaporation, yielded ſome ſmall cryſtals of ſelenite or gypſum.

6. From the other half of this ſolution, after evaporation by a gentle heat, about ten grains of ſmall ſhining cryſtals of a bitter taſte were obtained. On pouring ſome drops of vitriolic acid into the ſolution inſpiſſated by gentle heat, no precipitation, excepting of a little ſelenite, enſued; but as ſoon as it was inſpiſſated to the conſiſtence of honey, ſome fine acicular cryſtals, verging towards the ſame centre, began to form, but grew ſoft, and deliqueſced in a few days after.

1363
Manganeſe diſſolved by phlogiſticated nitrous acid.

7. Phlogiſticated nitrous acid diſſolves manganeſe as readily as the phlogiſticated vitriolic. A little levigated manganeſe mixed with ſome water was put into a large receiver, to which a tubulated retort was luted. Some ounces of common nitrous acid were put into the retort, to which ſome iron-filings were added, taking care always to cloſe the orifice with a glaſs ſtopple. The phlogiſticated nitrous acid thus paſſed over into the receiver, and diſſolved the manganeſe in a few hours: the ſolution was as limpid as water, excepting only a little fine ſiliceous earth. Another white precipitate, ſimilar to that produced by adding vitriolic acid to the ſolution in pure nitrous acid now began to fall; but in other reſpects this ſolution agreed with the former.

1364
Effects of it on ſpirit of ſalt.

8. An ounce of purified muriatic acid was poured upon half an ounce of levigated manganeſe; which, after ſtanding about an hour, aſſumed a dark brown colour. A portion of it was digeſted with heat in an open glaſs veſſel, and ſmelled like warm aqua-regia. In a quarter of an hour the ſmell was gone, and the ſolution became clear and colourleſs. The reſt of the brown ſolution being digeſted, to ſee whether the muriatic acid would be ſaturated with manganeſe, an efferveſcence enſued, with a ſtrong ſmell of aqua-regia, which laſted till next day, when the ſolution was found to be ſaturated. Another ounce of acid was poured upon the reſiduum, which was followed by the ſame phenomenon, and the manganeſe was entirely diſſolved, a ſmall quantity of ſiliceous earth only remaining. The ſolution, which was yellow, being now divided into two portions, ſome drops of vitriolic acid were poured into the one, by which it inſtantly became white, and a fine powder, inſoluble in water, was precipitated. Some ſmall cryſtals of ſelenite were formed by evaporation, and the reſiduum exhibited the ſame phenomenon with thoſe abovementioned with nitrous

1365
Entirely diſſolved by this acid.

trous acid, by evaporating the other half, ſome ſmall ſhining angular cryſtals were obtained, ſimilar to thoſe procured by means of the nitrous acid.

1366
Scarce ſoluble in fluor acid,

9. Very little manganeſe was diſſolved by fluor acid, even after ſeveral days digeſtion. A great quantity was required to form a ſaturated ſolution. It had very little taſte, and gave a ſmall quantity of precipitate with fixed alkali. But if a neutral ſalt, compoſed of fluor acid and ſal ammoniac, be added, a double decompoſition takes place, and the manganeſe is precipitated along with the fluor acid.

1367
Or in phoſphoric acid.

10. A drachm of phoſphoric acid, digeſted with as much powdered manganeſe, diſſolved but litle of it; and, though evaporated to dryneſs, the reſiduum taſted very acid; but by adding more manganeſe the acid was at laſt ſaturated. On adding microcoſmic ſalt to a ſolution of manganeſe, a decompoſition takes place ſimilar to that effected by the combination of fluor acid and volatile alkali.

1368
Partly ſoluble in acid of tartar.

11. Pure acid of tartar diſſolved manganeſe partly in the cold, and more effectually by means of heat. The whole, however, could not be diſſolved, though the acid was at laſt ſaturated by adding a great quantity of the mineral. On adding a ſolution of ſoluble tartar, a double decompoſition took place.

1369
With difficulty in the acetous.

12. Little was diſſolved by diſtilled vinegar, though boiled on manganeſe; but after diſtilling ſpirit of verdigris ſeveral times upon it, the acid at laſt became ſaturated. The ſolution, evaporated to dryneſs, left a deliqueſcent maſs. Little or none of the remaining manganeſe was diſſolved by concentrated vinegar, though repeatedly diſtilled upon it.

1370
Entirely diſſolved by acid of lemons;

13. With acid of lemons the whole was diſſolved with efferveſcence, excepting only ſome white earth.

1371
And by water impregnated with fixed air.

14. Water impregnated with fixed air likewiſe diſſolved manganeſe, but parted with it on the addition of alkali, or ſpontaneouſly by expoſure to the air.

1372
Has a ſtrong attraction for phlogiſton.

1373
Becomes white by ſaturation with phlogiſton.

From theſe experiments Mr Scheele concludes, that manganeſe has a ſtrong elective attraction for all phlogiſtic ſubſtances; and that this attraction becomes ſtronger, if there be preſent a menſtruum which can unite with the phlogiſticated manganeſe. Thus it attracts phlogiſton more powerfully than even the nitrous acid itſelf in the moiſt way. By ſaturation with phlogiſton, manganeſe has the property of loſing its black colour, and aſſuming a white one, which is unuſual, the phlogiſton generally communicating a black or dark colour to the ſubſtances with which it was united.

1374
Contains ſome phlogiſton naturally.

That manganeſe naturally contains ſome phlogiſton, though but in ſmall quantity, appears from evaporating a ſolution of it in vitriolic acid to dryneſs, and then diſtilling the maſs in a glaſs retort in an open fire. When the retort begins to melt, the acid parts fly off from the manganeſe in a ſulphureous ſtate, leaving the former of its natural black colour. By diſtilling the maſs remaining after evaporation of the nitrous ſolution, a green volatile nitrous acid remains, and the black calx of manganeſe remains as before. A ſolution of this mineral in vitriolic or nitrous acid, precipitated by fixed alkali, retains its colour; but when calcined in the open fire, again becomes black.

1375
Becomes inſoluble in pure acids by loſing its phlogiſton.

By loſing its phlogiſton, manganeſe becomes inſoluble in pure acids; and therefore the reſiduum of the abovementioned diſtillations cannot be diſſolved by adding more of the vitriolic or nitrous acids: but if that which has come over into the receiver be poured back into the retort, a ſolution will again take place by reaſon of the manganeſe reaſſuming the phlogiſton it had parted with to the acid.

1376
Partial ſolutions of manganeſe explained on this principle.

On this principle our author explains the reaſon of the partial ſolutions of this mineral abovementioned. Part of it is diſſolved, for inſtance, in the vitriolic acid, while the remainder is found inſoluble. This happens (ſays he), "becauſe the undiſſolved portion has parted with the little phlogiſton it naturally poſſeſſed to that portion of manganeſe which is taken up by the vitriolic acid during the firſt digeſtion; for without that principle it is inſoluble."

Manganeſe attracts phlogiſton more ſtrongly when combined with ſome acid than by itſelf, as appears from the following experiments.

1377
Strong attraction of manganeſe when combined with acids for phlogiſton.

1. Levigated manganeſe, digeſted or boiled with a ſolution of ſugar, honey, gum arabic, hartſhorn, jelly, &c. remains unchanged; but on mixing the pounded mineral with diluted vitriolic, or pure nitrous acid, and then adding ſome of theſe ſubſtances, the whole is diſſolved, the black colour vaniſhes by degrees, and the ſolution becomes as limpid as water. So ſtrong is the attraction of manganeſe for phlogiſton in theſe circumſtances, that metals, the noble ones not excepted, render it ſoluble in theſe acids in a limpid form. Concentrated vitriolic acid, indeed, diſſolves manganeſe entirely without any phlogiſton. "It would be difficult (ſays Mr Scheele) to comprehend whence the phlogiſton in this caſe ſhould come, if we were not certain that ſeveral ſubſtances, which have a great attraction for phlogiſton, can attract it in a red heat. Quickſilver and ſilver, when diſſolved in the pureſt nitrous acid, really loſe their phlogiſton, which is a conſtituent part of theſe metals. This appears from the red vapours in which the acid ariſes; and the diſſolved metallic earth cannot be again reduced to its metallic form, till it has acquired the loſt phlogiſton, which is effected either by precipitation with complete metals or by heat alone. Thus manganeſe can attract the quantity of phlogiſton neceſſary for its ſolution by means of concentrated vitriolic acid from heat. It is not probable that the concentrated acid undergoes a decompoſition in this degree of fire; for if you ſaturate half an ounce of this acid with alkali of tartar, and afterwards calcine in a retort, with a receiver applied, an ounce and a half of powdered manganeſe, with an equal quantity of the ſame vitriolic acid, then diſſolve the calcined maſs in diſtilled water, and likewiſe waſh well the receiver, which contains ſome drops of vitriolic acid, which are alſo to be added to the ſolution, and laſtly, add the ſame quantity of alkali, there will be no mark of ſuperabundant acid or alkali. Thence it may be concluded, that the phlogiſton in the vitriolic acid, if there really exiſts any in it, contributes nothing to the ſolution. But the manganeſe precipitated by alkali, contains a conſiderable quantity of it; in conſequence of which it is afterwards entirely ſoluble in acids without any addition.

1378
Why the concentrated acid of vitriol diſſolves manganeſe without addition.

1379
Why the volatile ſulphureous acid diſſolves it.

"The effects of volatile ſulphureous acid on manganeſe, clearly prove what has been aſſerted. The manganeſe attracts the phlogiſton contained in this acid, which is the cauſe of its great volatility, and which renders the former ſoluble in the new pure vitriolic acid. If this ſolution be mixed with concentrated vitriolic acid and diſtilled, no volatile ſulphureous acid is obtained; and if it be precipitated by means of fixed vegetable alkali, vitriolated tartar is obtained; which proves that manganeſe has a ſtronger attraction than vitriolic acid for phlogiſton in the moiſt way.

1380 Effects of nitrous acid on manganeſe explained.

"The effects of nitrous acid on this ſubſtance are ſimilar to thoſe of vitriolic acid. Could ſpirit of nitre ſuſtain as great a degree of heat as the concentrated vitriolic acid, it would alſo entirely diſſolve the manganeſe by means of the phlogiſton attracted by heat; but as this is not the caſe, it is neceſſary to add phlogiſton in the manner abovementioned. The manganeſe decompoſes phlogiſticated nitrous acid, for the ſame reaſon that it does the volatile ſulphureous acid; and that the phlogiſton of this acid really combines with manganeſe, is manifeſt from this, that the affuſion of vegetable acid produces no ſmell of aquafortis by diſplacing the phlogiſticated acid of nitre. By diſtillation with pure vitriolic acid alſo, the nitrous acid is expelled, not in a ſmoking ſtate, and of a yellow colour, but pure and colourleſs.

"In the ſolution of manganeſe by means of gum arabic or ſugar, a very conſiderable efferveſcence takes place, owing to the extrication, or probably rather the production, of fixed air from the mixture; but with phlogiſticated acid of nitre no ſuch phenomenon takes place, becauſe the manganeſe is combined with pure phlogiſton; and if this ſhould be again ſeparated, there is no cauſe for the production of fixed air. This mineral is alſo diſſolved without effervescence, by uniting it with nitrous acid and metals, arſenic or oil of turpentine."

1381 Exiſtence of phlogiſton in the muriatic acid proved

As muriatic acid diſſolves manganeſe without addition, Mr Scheele is of opinion that this proves the exiſtence of phlogiſton in that acid, as has already been taken notice of. The manganeſe digeſted in the cold with ſpirit of ſalt aſſumes a dark brown colour; for it is a property of this ſubſtance that it cannot be diſſolved into a colourleſs liquor without phlogiſton, but has always a red or blue colour; but with ſpirit of ſalt the ſolution is more brown than red, on account of the fine particles of the manganeſe floating in the liquid. Here the mineral adheres but looſely to the acid, ſo that it may be precipitated by water.

1382 Explanation of the action of acid of tartar and acid of lemons.

The effects of acid of tartar and acid of lemons upon manganeſe are likewiſe explained on the principle already laid down, *viz.* the extreme attraction this ſubſtance has for phlogiſton. Thus it attracts part of that naturally contained in theſe acids, decompoſing one part of them, and being diſſolved by the other. This deſtruction of the acid is ſimilar to that of the ſugar, gum arabic, &c. which render it ſoluble in nitrous acid; for if a proper quantity of theſe are added, the manganeſe will be diſſolved, without a poſſibility of recovering the ſmalleſt particle of the vegetable ſubſtance employed; and if the ſolution be ſlowly evaporated and calcined, there will not remain the ſmalleſt mark of burned ſugar or gum. During this decompoſition, a pungent vapour ariſes, which, being collected, appears to be true vinegar. It is obtained in its pureſt ſtate from diluted vitriolic acid, ſugar, and manganeſe.

1383 Of fluor acid.

Fluor acid diſſolves but very little manganeſe, owing to its precipitating ſalt which envelopes the particles of manganeſe, and prevents the further action of the menſtruum. In all precipitations of manganeſe, however, by means of mild fixed alkalies, the full quantity is not procured; becauſe the fixed air, detached from the mineral, diſſolves part of it.

1384 Effects of manganeſe on nitre.

Though manganeſe decompounds nitre, yet this does not happen till the mixture becomes red hot. If phlogiſticated manganeſe be mixed with an equal quantity of nitre, and diſtilled in a glaſs retort, the mixture begins to grow black before the retort becomes red-hot, but no nitrous acid goes over. By lixiviation, no mark of uncombined alkali is met with; but phlogiſticated nitrous acid is extricated by the application of tamarinds, or any vegetable acid. Three parts of phlogiſticated manganeſe, mixed with one part of finely pounded nitre, yields no nitrous acid, though the nitre is alkalized as ſoon as the mixture becomes black in the retort.

1385 Experiments on manganeſe united with phlogiſton.

Mr Scheele proceeds now to another ſet of experiments upon manganeſe united with phlogiſton. In order to procure it in this ſtate, the beſt method is to diſſove in diſtilled water, and cryſtallize the ſalt obtained by ſolution of manganeſe in vitriolic acid, and then precipitate it with vegetable fixed alkali. In this ſtate it is white like chalk: but by calcination in an open fire, the ſuperfluous phlogiſton flies off, and the calx regains its uſual black colour. This change of colour likewiſe happens when the precipitation is made with cauſtic alkalies, whether fixed or volatile. The precipitate, indeed, in this caſe, is white when kept cloſe from the air, but aſſumes a brown colour when expoſed to it for any time: But when the precipitation is made by mild alkali, the white colour is preſerved by the fixed air, which in this caſe it alſo contains. By diluting the ſolution with a conſiderable quantity of water, and precipitating with cauſtic alkali, the precipitate is brown from the very beginning, owing to the air in the liquid attracting the phlogiſton from the manganeſe. The precipitate formed by lime-water is alſo brown; but on adding more of a ſtrong ſolution of manganeſe, and afterwards precipitating with cauſtic alkali, the powder falls of a white colour; becauſe the air, being already ſaturated with phlogiſton, cannot take up any more. The reſults of Mr Scheele's experiments on this phlogiſticated manganeſe are,

1386 By diſtillation *per ſe.*

1. An ounce of this ſubſtance diſtilled by itſelf in a glaſs retort, with a ſtrong fire, yielded a great quantity of fixed air with ſome drops of water. The reſiduum poured warm out of the retort grew red-hot, and ſet the paper on fire.

2. On repeating the experiment with only a drachm of phlogiſticated manganeſe, and tying a bladder to the neck of a retort, three ounce-meaſures of air came over: the reſiduum was of a light grey colour; diſſolved in acids without addition of any more phlogiſton; and took fire in that degree of heat in which ſulphur ſmokes, but does not burn. From theſe experiments, ſays Mr Scheele, it is evident, that phlogiſton does not ſeparate from manganeſe if the acceſs of air be prevented.

1387 Boiled with oil olive.

2. One part of finely powdered manganeſe boiled in four of oil-olive, effervesced violently, and diſſolved into a kind of ſalve.

1388 By diſtillation with charcoal.

4. On diſtilling a mixture of finely powdered manganeſe and charcoal, with an empty bladder tied to the mouth of the retort, a quantity of fixed air was extri-

cated when the retort began to melt and diſtended the bladder. The reſiduum was moſtly ſoluble in diluted vitriolic acid.

1389 With ſulphur. 5. On diſtilling half an ounce of powdered manganeſe with two drachms of ſulphur, the latter partly roſe into the neck of the retort, and ſome volatile acid vapours penetrated through the lute. The diſtillation was continued till the retort began to melt; and, on cooling, the reſiduum was found to weigh 5½ drachms. It was of a yellowiſh-grey colour; and diſſolved in ſpirit of vitriol with efferveſcence, yielded an hepatic ſmell, ſome ſulphur being alſo precipitated at the ſame time. By calcination in the open air, the ſulphur was diſſipated; but great part of the maſs was rendered ſoluble on account of its having been penetrated by the acid vapour, and ſhot into cryſtals as though it had been formally diſſolved in volatile ſulphureous acid; and by repeating the calcination with more ſulphur, the whole became at laſt entirely ſoluble, and was reduced to cryſtals.

1390 By calcination with nitre. Finely powdered manganeſe, triturated with nitre and ſtrongly calcined in a crucible, unites with the alkali of the nitre, while the acid is diſſipated in the air. The maſs formed by the union of the manganeſe and alkali is of a dark green colour, and ſoluble in water, communicating alſo a green colour to the liquid; but in a ſhort time a fine yellow powder (an ochre of iron) falls to the bottom, leaving the liquor of a blue colour. By the addition of water, this ſolution firſt aſſumes a violet colour, grows afterwards red, and a precipitation of the manganeſe takes place, which reſumes its natural colour as ſoon as it has fallen. The ſame precipitation takes place on the addition of a few drops of acid, or by expoſure for ſome days to the open air. As for the dark red colour aſſumed by the ſolution when the precipitate is about to fall, Mr Scheele conjectures that the particles of manganeſe may naturally have a red colour, which becomes viſible when the ſubſtance is diſperſed through a menſtruum without being perfectly diſſolved.

1391 With the addition of arſenic. 7. By the addition of finely powdered white arſenic to the alkaline maſs of nitre and manganeſe, the green colour diſappears, and the whole becomes white; phlogiſticated manganeſe being alſo precipitated on the addition of water. This ariſes from the more powerful attraction of manganeſe for the phlogiſton of the arſenic than that of the arſenical acid itſelf; and for the ſame reaſon, if the maſs be calcined with charcoal, or any other phlogiſtic ſubſtance, a colourleſs ſolution will be obtained.

1392 By diſtillation with ſal ammoniac. 8. Half an ounce of phlogiſticated manganeſe, diſtilled in a retort with an equal quantity of powdered ſal ammoniac, yielded firſt a concrete volatile ſalt, after which ſome ſal ammoniac undecompoſed aroſe in the neck of the retort. Half an ounce of pure dephlogiſticated manganeſe, mixed with two drachms of powdered ſal ammoniac, yielded alkali in its cauſtic ſtate. Both reſiduums were ſoluble in water; which ſhows that manganeſe attracts phlogiſton from the volatile alkali.

1393 By diſtillation with pure nitrous acid. 9. On digeſting finely powdered manganeſe for ſome weeks with pure nitrous acid and ſome volatile alkali, a great number of air-bubbles riſe to the top, and the volatile alkali is entirely decompoſed: for though the mixture be afterwards diſtilled in a retort with the addition of quicklime, not the leaſt urinous ſmell can be perceived. This decompoſition is effected by the manganeſe attracting the phlogiſton of the volatile alkali; for that the nitrous acid has no ſhare in this, is proved by the following experiment.

1394 Volatile alkali deſtroyed by manganeſe attracting its phlogiſton. 10. An ounce of well triturated manganeſe was diſtilled with half an ounce of ſal ammoniac; and a liquid alkali, ſuch as that obtained from ſal ammoniac and quicklime, was procured. On repeating this experiment, with the variation only of a bladder inſtead of a receiver, the ſame kind of air was obtained as that which riſes to the top of the nitrous mixture. Though the emiſſion of this air indicated a deſtruction of the volatile alkali, our author explains the reaſon of its being ſtill obtained in a cauſtic ſtate by the phlogiſton taken from the alkali being more than ſufficient to render the alkali ſoluble in muriatic acid; in conſequence of which, the ſuperfluous quantity combines with the manganeſe, and enables it to decompoſe the ſal ammoniac in the ordinary way. It muſt be owned, however, that his reaſoning on this ſubject is not entirely ſatisfactory, nor does the account he gives of his experiments ſeem entirely conſiſtent with itſelf. See *Scheele's Chem. Eſſays*, Eſſay V. § xxxix.

1395 By diſtillation with arſenic. 11. Powdered manganeſe, diſtilled with an equal quantity of white arſenic, underwent no change, the arſenic flying off in its proper form; but with an equal quantity of yellow orpiment, ſome volatile ſulphureous acid came over firſt, then a yellow ſublimate, and at laſt a little red ſublimate aroſe. On augmenting the fire by degrees, the orpiment remained obſtinately attached to it. Similar effects enſued on treating manganeſe with an equal quantity of antimony; which likewiſe yielded a pungent ſulphureous acid, but no ſublimate. By calcination in the open air theſe compounds are decompoſed; and the manganeſe, united with vitriolic acid, becomes ſoluble in water.

1396 With cinnabar. 12. On diſtilling manganeſe with an equal quantity of finely pounded cinnabar, a volatile ſulphureous acid came over firſt; then a little cinnabar was ſublimed into the neck of the retort; and at laſt the quickſilver, which had been the baſis of the cinnabar, began to diſtil: the reſiduum, being a combination of manganeſe and ſulphur, was ſimilar to the compounds already deſcribed.

1397 With corroſive ſublimate. 13. With an equal quantity of corroſive ſublimate, manganeſe underwent no change; but when ſublimed with an equal quantity of mercurius dulcis, a corroſive ſublimate, and then mercurius dulcis, aroſe into the neck of the retort. The reaſon of this is, that the mercurius dulcis contains a portion of phlogiſton; by being deprived of which it ceaſes to be mercurius dulcis, and becomes corroſive ſublimate: but by reaſon of the ſtrong attraction of manganeſe for phlogiſton, the mercurius dulcis parts with that portion which is neceſſary to keep it in its mild ſtate, and thus is converted into corroſive mercury.

SECT. IV. *Inflammable Subſtances.*

1398 General diviſion. THESE may be divided into the following claſſes: 1. Sulphurs. 2. Ardent ſpirits. 3. Oils and fats. 4. Reſins. 6. Bitumens; and, 6. Charcoal.

§ 1. SULPHURS.

1399 Sulphur. 1. *Common ſulphur.* For the extraction of this ſubſtance from its ores, ſee SULPHUR. The artificial compoſition of it we have already related, n° 715; and have now only to take notice of a very few of its properties, which come more properly under this ſection.

Sulphur, as commonly uſed in commerce and the arts, is of a pale yellow colour, of a diſagreeable and peculiar ſmell, which is rendered more ſenſible when it is heated or rubbed. By rubbing, it receives very curious electrical qualities: (See ELECTRICITY.) Its ſpecific gravity is conſiderably greater than that of water, though leſs than earths or ſtones. In cloſe veſſels, ſulphur is incapable of receiving any alteration. It melts with a very gentle heat; and then is ſublimed, adhering to the capital in ſmall, very fine, needle-like cryſtals, called *flowers of ſulphur*. It may thus be ſublimed many times without alteration.

1400 Cryſtallization.

If ſulphur is expoſed to a heat barely ſufficient to melt it, and very ſlowly cooled, it cryſtallizes in form of many needles croſſing one another. Some of theſe pointed cryſtals may alſo be obſerved in the interior parts of the lumps of ſulphur which have been melted, and caſt into cylyndrical moulds, as they are commonly ſold; becauſe the centre of theſe cylindrical rolls is more ſlowly cooled than the ſurface. Sulphur alſo gives this needle-like form to cinnabar, antimony, and many other minerals containing it. Sulphur may be decompoſed in ſeveral ways. The moſt ſimple is by burning; which we have already taken notice of, n° 623. It may alſo be very effectually decompoſed by mixing it with iron filings and water. In this caſe the phlogiſton is diſſipated, and the acid uniting with the iron forms a green vitriol.

1401 Decompoſed by a ſuperabundance of phlogiſton. It is very remarkable, that though ſulphur is compoſed of vitriolic acid and phlogiſton, yet the addition of more inflammable matter, ſo far from making the union ſtronger, weakens it to a great degree: and hence we have another method of decompoſing this ſubſtance; namely, by combining it with a large quantity of oil, and diſtilling the compound.

Sulphur is capable of being eaſily diſſolved in expreſſed oils, but very difficultly in eſſential ones. Theſe compoſitions are called *balſams of ſulphur;* and are ſometimes employed in medicine, but are found to be of a very heating nature. They are much uſed by farriers. According to Mr Beaumé, ſulphur cannot be diſſolved in oil, without a heat ſufficient to melt it. A larger quantity is kept diſſolved when the mixture is hot, than when cold; and conſequently the ſulphur, eſpecially if it has been diſſolved in a thin eſſential oil, cryſtallizes on cooling the mixture. The ſulphur, thus ſeparated from the oil, is found not to be altered in any reſpect from what it formerly was; but if the mixture is expoſed to a degree of heat capable of entirely decompoſing the oil, the ſulphur is decompoſed along with it, and the ſame products are obtained by diſtilling this mixture to dryneſs, as if a mixture of pure oil of vitriol and oil were diſtilled. Theſe products are, firſt a portion of oil, when an eſſential oil was made uſe of in the compoſition of the balſam; then ſome volatile ſulphureous acid, which is at firſt watery, and afterwards becomes ſtronger; along with this acid more oil ariſes, which becomes more and more thick towards the end of the diſtillation; and laſtly, when the retort has been made red hot, nothing remains but a fixed coal.

In this proceſs we find, that both the ſulphur and oil are decompoſed. The acid of the ſulphur ſeems to attack the watery principle of the oil, while its phlogiſton remains confounded with that of the oil, or is diſſipated in vapours. Hence, though the vitriolic acid in ſulphur is concentrated to the utmoſt degree, and perfectly free from water, what riſes in this diſtillation is very aqueous, by reaſon of the water which it attracts from the oil.

1402 How ſoluble in ſpirit of wine. Spirit of wine does not ſenſibly act upon ſulphur in its liquid ſtate; but if both the ſpirit of wine and ſulphur meet in the ſtate of vapour, they will then unite, and a perfect ſolution will take place. By methods of this kind, many combinations might be effected, which have been hitherto thought impoſſible.

1403 Its union with metals. Pure ſulphur unites eaſily with all metals; gold, platina, and zinc, excepted. The compounds, except that with mercury, poſſeſs a metallic luſtre without any ductility. The ſulphur may be ſeparated by expoſing the mixture to a ſtrong fire. (See METALLURGY,) or by diſſolving the metalline part in acids. The ſulphur, however, defends ſeveral of the metals from the action of acids; ſo that this diſſolution ſucceeds but imperfectly. The reguline part of antimony is more eaſily ſeparated from ſulphur by means of acids than by any other metalline ſubſtance. Alkaline ſalts will ſeparate the ſulphur from all metals in fuſion, but they unite with it themſelves, and form a compound equally capable of diſſolving the metal.

1404 Vermilion. Sulphur united with quickſilver forms the beautiful pigment called *cinnabar*, or *vermilion;* which is ſo much uſed in painting, that the making of it is become a diſtinct trade. Neumann relates, that in the making of cinnabar by the Dutch method, ſix or eight parts of quickſilver are made uſe of to one of ſulphur. The ſulphur is firſt melted, and then the quickſilver is ſtirred into it; upon which they unite into a black maſs. In this part of the proceſs the mixture is very apt to take fire; of which it gives notice by ſwelling up to a great degree. The veſſel muſt then be immediately covered. The maſs being beaten to powder, is afterwards to be ſublimed in large earthen jars almoſt of an equal wideneſs from end to end; theſe are hung in a furnace by a ſtrong rim of iron. When the matter is put in, the mouth of the veſſel is covered, the fire increaſed by degrees, and continued for ſeveral hours, till all the cinnabar has ſublimed; care being taken to introduce at times an iron rod to keep the middle clear; otherwiſe the cinnabar concreting there, and ſtopping up the paſſage would infallibly burſt the veſſels.

The quantity of ſulphur directed in the common receipts for making cinnabar is greatly larger than the above; being no leſs than one-third of the quantity of quickſilver employed: accordingly it has been found, that the ſublimate, with ſuch a large quantity of ſulphur, turned out of a blackiſh colour, and required to be ſeveral times ſublimed before it became perfectly red; but we cannot help thinking, that by one gentle ſublimation the ſuperfluous ſulphur might be ſeparated, and the cinnabar become perfectly pure the ſecond time. Hoffman gives a curious method of making cinnabar without ſublimation: by ſhaking or digeſting a little mercury with volatile tincture of ſulphur, the mercury readily imbibes the ſulphur from the volatile ſpirit, and forms with it a deep red powder, not inferior in colour to the cinnabar prepared in the common manner. Dr Lewis has found the common ſolutions of ſulphur by alkalies, or quicklime, to have a ſimilar effect. This cinnabar will likewiſe be of a darker or lighter colour, according as the ſolution contains more or leſs ſulphur.

1405 Pulvis fulminans.

Sulphur is a principal ingredient in gun-powder, (ſee GUN-POWDER.) It alſo enters the compoſition of the *pulvis fulminans*. This conſiſts of three parts of nitre, two of the dry alkali of tartar, and one part of ſulphur, well ground together. If a little quantity of this powder is laid on an iron-ſpoon or ſhovel, and ſlowly heated, it will explode, when it arrives at a certain degree of heat, with aſtoniſhing violence and noiſe. The moſt probable opinion concerning this is, that the fixed air contained in the alkali is, by the acid vapours acting upon and endeavouring to expel it all at once, driven off with ſuch force, that a loud exploſion is produced.

1406 Phoſphorus of urine.

2. *Phoſphorus of Urine*. This is a very inflammable ſubſtance, compoſed of phlogiſton united with a certain acid, the properties of which we have already taken notice of, nº 904 *et ſeq*. The preparation of it was long a ſecret, and only perfectly diſcovered by Mr Margraaf, who publiſhed it in the Berlin Memoirs in 1743. This proceſs being by far the beſt and moſt practicable, we ſhall content ourſelves with inſerting it alone.

1407 Mr Margraaf's proceſs for making.

Two pounds of ſal ammonaic are to be accurately mixed with four pounds of minium, and the mixture diſtilled in a glaſs retort; by which means a very penetrating, cauſtic alkaline ſpirit will be obtained. The reſiduum, after the diſtillation, is a kind of *plumbum corneum*; nº 812. This is to be mixed with nine or ten pounds of extract of urine, evaporated to the conſiſtence of honey. (Seventy or eighty gallons of urine are required to produce this quantity of extract.) The mixture is to be made ſlowly in an iron pot ſet over the fire, and the matter frequently ſtirred. Half a pound of powdered charcoal is then to be added, and the evaporation continued till the whole is reduced to a black powder. This powder is to be put into a retort, and urged with a graduated heat, till it becomes red hot, in order to expel all the volatile alkali, fetid oil, and ammoniacal ſalt, that may be contained in the mixture. After the diſtillation, a black friable reſiduum remains, from which the phoſphorus is to be extracted by a ſecond diſtillation and a ſtronger heat. Before it is ſubjected to another diſtillation, it may be tried by throwing ſome of it upon hot coals. If the matter has been well prepared, a ſmell of garlic exhales from it, and a blue phoſphorical flame is ſeen undulating along the ſurface of the coals.

The matter is to be put into a good earthen retort, capable of ſuſtaining a violent fire. Three quarters of the retort are to be filled with the matter which is to yield the phoſphorus, and it is to be placed in a furnace capable of giving a ſtrong heat. Mr Margraaf divides the matter among ſix retorts, ſo that if any accident happens to one, the whole matter is not loſt. The retorts ought to be well luted to a receiver of a moderate ſize, pierced with a ſmall hole, and half full of water; and a ſmall wall of bricks muſt be raiſed between the furnace and receiver, in order to guard this veſſel againſt heat as much as poſſible. The retorts are to be heated by ſlow degrees for an hour and an half; then the heat is to be increaſed till the veſſels are red hot, when the phoſphorus aſcends in luminous vapours. When the retort is heated till between a red and white, the phoſphorus paſſes in drops, which fall and congeal in the water at the bottom of the receiver. This degree of heat is to be continued till no more comes over. When a retort contains eight pints or more, this operation continues about five hours.

1408 Rectification of phoſphorus.

In the firſt diſtillation, phoſphorus never paſſes pure, but is always of a blackiſh colour, by reaſon of its carrying along with it ſome part of the coal. From this, however, it may be purified by rectification in a ſmall glaſs-retort, to which is luted a receiver half full of water. A very gentle heat is ſufficient; becauſe phoſphorus, once formed, is very volatile; and as the fuliginous matter was raiſed probably by the fixed air emitted by the charcoal in the inſtant of its union with the phoſphorine acid, none of it can ariſe in a ſecond diſtillation.

The phoſphorus is then to be divided into ſmall cylindrical rolls, which is done by putting it in glaſs-tubes immerſed in warm water; for the phoſphorus is almoſt as fuſible as ſuet. It takes the form of the glaſs-tubes; from which it may be taken out, when it is cold and hardened. This muſt be done under water, leaſt the phoſphorus ſhould take fire.

1409 Proceſs ſometimes dangerous.

This concrete continually appears luminous in a dark place; and by a very ſlight heat takes fire, and burns far more vehemently than any other known ſubſtance. Hence it is neceſſary to be very cautious in the diſtillation of it; for if the receiver ſhould happen to break while the phoſphorus is diſtilling, and a little flaming phoſphorus fall upon the operator's legs or hands, it would burn its way to the bone in leſs than three minutes. In this caſe, according to Mr Hellot, nothing but urine will ſtop its progreſs.

Though phoſphorus takes fire very readily by itſelf, it does not inflame at all by grinding it with other inflammable bodies, as camphor, gun-powder, or eſſential oils. In grinding it with nitre, ſome luminous flaſhes are obſerved; but the mixture never burns, unleſs the quantity of phoſphorus be large in proportion to the nitre: rubbed pretty hard on a piece of paper or linen, it ſets them on fire if they are rough, but not if they are ſmooth. It fires written paper more readily than ſuch as is white, probably from the former having more aſperities. On grinding with iron-filings, it preſently takes fire.

1410 Liquid phoſphorus.

Oils ground with phoſphorus appear, like itſelf, luminous in a temperately warm place; and thus become a liquid phoſphorus, which may be rubbed on the hands, &c. without danger. Liquid phoſphorus is commonly prepared by grinding a little of the ſolid phoſphorus with oil of cloves, or rubbing it firſt with camphor, and this mixture with the oil. A luminous *amalgam*, as it is called, may be obtained, by digeſting a ſcrua ſcraple of ſolid phoſphorus with half an ounce of oil of lavender, and, when the phoſphorus begins to diſſolve and the liquor to boil, adding a drachm of pure quickſilver; then briſkly ſhaking the glaſs for five or ſix minutes till they unite.

1411 Experiments on phoſphorus with ſpirit of wine.

Rectified ſpirit of wine, digeſted on phoſphorus, extracts a part of it, ſo as to emit luminous flaſhes on being dropt into water. It is computed that one part of phoſphorus will communicate this property to 600,000 parts of ſpirit. The liquor is never obſerved to become luminous of itſelf, nor in any other circumſtance except that abovementioned. By digeſtion for ſome months, the undiſſolved phoſphorus is reduced to a tranſparent oil, which neither emits light nor concretes in the cold. By waſhing with water, it is in ſome meaſure revived; acquiring a thicker conſiſtence, and becoming again luminous, though in a leſs degree than at firſt. During this digeſtion, the glaſs is very apt to burſt.

1412 With eſſential oils and acids.

Phoſphorus is partially diſſolved by expreſſed oils; and totally, or almoſt ſo, in eſſential oils and ether. When eſſential oils are ſaturated with it by heat, a part of the phoſphorus ſeparates, on ſtanding in the cold, in a cryſtallize form. Concentrated ſpirit of ſalt has no action on it. In diſtillation, the ſpirit riſes firſt, and the phoſphorus after it unchanged. Spirit of nitre diſſolves it, and the diſſolution is attended with great heat and copious red fumes; ſo that great part of the ſpirit diſtils without the application of any external heat, and the phoſphorus at laſt takes fire, explodes, and burſts the veſſels. Oil of vitriol likewiſe diſſolves phoſphorus, but not without a heat ſufficient to make the acid diſtil. The diſtilled liquor is white, thick, and turbid; the reſiduum is a whitiſh tenacious maſs, which deliquates, but not totally, in the air. Phoſphorus itſelf is reſolved into an acid liquor on being expoſed two or three weeks to the air, its inflammable principle ſeeming by degrees to be diſſipated.

Phoſphorus has been reported to produce extraordinary effects in the reſolution of metallic bodies: but from the experiments that have been made with this view, it does not appear to have any remarkable action on them; at leaſt on the precious ones, gold and ſilver, for the reſolution or ſubtilization of which it has been chiefly recommended. The following experiments were made by Mr Margraaf.

1413 Mr Margraaf's experiments with metals.

1. A ſcruple of filings of gold were digeſted with a drachm of phoſphorus for a month, and then committed to diſtillation. Part of the phoſphorus aroſe, and part remained above the gold, in appearance reſembling glaſs: this grew moiſt on the admiſſion of air, and diſſolved in water, leaving the gold unaltered. Half a drachm of fine ſilver, precipitated by copper, being digeſted with a drachm of phoſphorus for three hours, and the fire then increaſed to diſtillation, greateſt part of the phoſphorus aroſe pure, and the ſilver remained unchanged Copper filings being treated in the ſame manner, and with the ſame quantity of phoſphorus, the phoſphorus ſublimed as before, but the remaining copper was found to have loſt its metallic brightneſs, and to take fire on the contact of flame. Iron filings ſuffered no change. Tin filings run into granules, which appeared to be perfect tin. Filings of lead did the ſame. The red calx of mercury, called *precipitate per ſe*, treated in the ſame manner, was totally converted into running quickſilver. 2. Regulus of antimony ſuffered no change itſelf, but occaſioned a change in the conſiſtence of the phoſphorus; which, after being diſtilled from this ſemimetal, refuſed to congeal, and continued, under water, fluid like oil-olive. With biſmuth there was no alteration. A drachm of phoſphorus being diſtilled and cohobated with an equal quantity of zinc, greateſt part of the zinc ſublimed in form of very light pointed flowers of a reddiſh-yellow colour: theſe flowers, injected into a red hot crucible, took fire, and run into a glaſs reſembling that of borax. White arſenic, ſublimed with phoſphorus, aroſe along with it in form of a mixed red ſublimate. Sulphur readily unites with phoſphorus into a maſs which ſmells like *hepar ſulphuris*. This does not eaſily take fire on being rubbed; but expoſed to a moderate dry heat, it flames violently, and emits a ſtrong ſulphureous fume. If phoſphorus is burnt in an open veſſel, a quantity of acid remains behind; and if a glaſs bell is held over it, an acid likewiſe ſublimes in the form of white flowers.

1414 Mr Canton's phoſphorus.

3. *Mr Canton's phoſphorus.* This is a compoſition of quicklime and common ſulphur. The receipt for making it is as follows. "Calcine ſome common oyſter-ſhells, by keeping them in a good coal-fire for half an hour; let the pureſt part of the calx be pulverized and ſifted. Mix with three parts of this powder one part of flowers of ſulphur. Let this mixture be rammed into a crucible of about an inch and a half in depth till it be almoſt full; and let it be placed in the middle of the fire, where it muſt be kept red hot for an hour at leaſt, and then ſet by to cool: when cold, turn it out of the crucible; and cutting or breaking it to pieces, ſcrape off, upon trial, the brighteſt parts; which, if good phoſphorus, will be a white powder. This kind of phoſphorus ſhines on being expoſed to the light of the ſun, or on receiving an electrical ſtroke.

1415 Homberg's phoſphorus or pyrophorus.

4. *Phoſphorus of Homberg.* This ſubſtance, which has the ſingular property of kindling ſpontaneouſly when expoſed to the air, was accidentally diſcovered by Mr Homberg, as he was endeavouring to diſtil a clear flavourleſs oil from human excrements. Having mixed the excrement with alum, and diſtilled over as much as he could with a red heat, he was much ſurpriſed at ſeeing the matters left in the retort take fire upon being expoſed to the air, ſome days after the diſtillation was over. This induced him to repeat the operation, in which he met with the ſame ſucceſs; and he then publiſhed a proceſs, wherein he recommended alum and human excrement for the preparation of the phoſphorus. Since his time, however, the proceſs has been much improved: and it is diſcovered, that almoſt every vitriolic ſalt may be ſubſtituted for the alum, and moſt other inflammable ſubſtances for the excrement; but though alum is not abſolutely neceſſary for the ſucceſs, it is one of the vitriolic ſalts that ſucceed beſt. The following proceſs is recommended in the Chemical Dictionary.

1416 Beſt method of preparing.

Let three parts of alum and one of ſugar be mixed together. This mixture muſt be dried in an iron ſhovel, over a moderate fire, till it be almoſt reduced to a blackiſh powder or coal; during which time it muſt be ſtirred with an iron ſpatula. Any large maſſes muſt be bruiſed into powder; and then it muſt be put into a glaſs matraſs, the mouth of which is rather ſtrait than wide, and ſeven or eight inches long. This matraſs is to be placed in a crucible, or other earthen veſſel, large enough to contain the belly of the matraſs, with about a ſpace equal to that of a finger all round it. This ſpace is to be filled with ſand, ſo that the matraſs ſhall not touch the earthen veſſel. The apparatus is then to be put into a furnace, and the whole to be made red hot. The fire muſt be applied gradually, that any oily or fuliginous matter may be expelled; after which, when the matraſs is made red hot, ſulphureous vapours exhale: this degree of heat is to be continued till a truly ſulphureous flame, which appears at the end of the operation, has been ſeen nearly a quarter of an hour: the fire is then to be extinguiſhed, and the matraſs left to cool, without taking it out of the crucible; when it ceaſes to be red hot, it muſt be ſtopped with a cork. Before the matraſs is perfectly cold, it muſt be taken out of the crucible, and the powder it contains poured as quickly as poſſible into a very dry glaſs phial, with a glaſs ſtopper. If we would preſerve this phoſphorus a long time, the bottle containing it muſt be opened as ſeldom as poſſible. Sometimes it kindles while it is pouring into the glaſs phial; but it may be then extinguiſhed by cloſing the phial expeditiouſly. A ſmall quantity of this pyrophorus laid on paper, and expoſed to the air, immediately takes fire, becomes red like burning coals, and emits a ſtrong ſulphureous vapour greatly reſembling that which ariſes on decompoſing liver of ſulphur.

1417
Is not injured by mere expoſure to light.

It has been generally alleged, that the common black phoſphorus is impaired by being expoſed to the light; but Mr Cavallo has diſcovered the fallacy of this ſuppoſition by the following experiment. Some portions of the ſame pyrophorus were incloſed in three glaſs tubes, and immediately ſealed up hermetically. On the 22th of May 1779, two of them were ſuſpended from a nail out of a window, and the third was wrapped up in paper and incloſed in a box, where not the leaſt glimmering of light could enter. In this ſituation they were left for more than a year; after which one of thoſe that had been kept out of the window was broke, along with that which had been kept in the dark, in the preſence of Mr Kirwan; when the pyrophorus ſeemed to be equally good in each tube, taking fire in about half a minute after it was taken out of the tubes, and expoſed to the air on a piece of paper.

1418
Cauſe of the accenſion.

There are many different kinds of pyrophori: ſome of the moſt remarkable of which are deſcribed under the article PYROPHORUS. Many theories have been invented to ſolve the phenomenon of their accenſion on the contact of air. This has been thought owing to the converſion of the earth of alum into lime, or to a remainder of the vitriolic acid attracting moiſture from the atmoſphere; but the formation of pyrophorus without either alum or vitriolic acid, ſhows that neither of theſe opinions can be juſt. It is more probable, therefore, that, the heat is occaſioned by the total diſſipation of that aqueous part which is eſſential to the conſtitution of terreſtrial ſubſtances. In conſequence of this, the water contained in the atmoſphere is not only attracted with avidity, but decompounded by the matter reduced to ſuch a ſtate of extreme dryneſs. By theſe operations it gives out the latent heat contained in it, and this produces the accenſion in queſtion.

§ 2. *ARDENT SPIRITS.*

See FERMENTATION and DISTILLATION.

§ 3. *OILS.*

1419
Eſſential oils.

1. *Eſſential Oils.* Thoſe oils are called *eſſential* which have evidently the ſmell of the vegetable from which they are drawn. For the method of procuring them, ſee DISTILLATION. They are diſtinguiſhed from all others by their ſuperior volatility, which is ſo great as to cauſe them riſe with the heat of boiling water. All theſe have a ſtrong aromatic ſmell, and an acrid, cauſtic taſte; in which reſpect alſo they differ from other oils. This taſte is thought to proceed from a copious and diſengaged acid, with which they are all penetrated. The preſence of this diſengaged acid in eſſential oils, appears from the impreſſion they make upon the corks of bottles in which they are kept. Theſe corks are always ſtained of a yellow colour, and a little corroded, nearly as they are by nitrous acid. The vapour of theſe oils alſo reddens blue paper, and converts alkalies into neutral ſalts.

1420
Suppoſed cauſe of their taſte.

1421
Of their ſolubility in ſpirit of wine.

This acid is likewiſe ſuppoſed to be the cauſe of their ſolubility in ſpirit of wine. They are not all equally ſoluble in this menſtruum, becauſe they do not all contain an equal quantity of acid. As this acid is much diſengaged, they loſe a great deal of it by repeated diſtillations, and therefore they become leſs and leſs ſoluble on being frequently diſtilled. By evaporation they loſe their moſt volatile and thin part, in which the ſpecific ſmell of the vegetable from which they are extracted reſides; by which loſs they become thick, and acquire the ſmell and conſiſtence of turpentine, and even of reſins. In this ſtate they are no longer volatile with the heat of boiling water; and, if diſtilled with a ſtronger fire, they give over an oil which has neither ſmell nor taſte of the vegetable whence they were extracted, but is entirely empyreumatic, and ſimilar to thoſe oils procured by diſtilling vegetable or animal ſubſtances with a ſtrong fire. See DISTILLATION.

1432
Camphor.

To the claſs of eſſential oils, the volatile concrete called *camphor* ſeems moſt properly to belong. With them it agrees in its properties of inflammability, ſolubility in ſpirit of wine, and a ſtrong aromatic flavour. The only differences between them are, that camphor is always in a ſolid ſtate, and is incapable of decompoſition by any number of ſublimations.

1423
Decompoſed by diſtillation with bole.

1424
With dephlogiſticated nitrous acid.

It has, however, been found poſſible to decompoſe it by diſtillation with certain additions. By diſtilling it ſeveral times along with bole, we obtain a fluid having the properties of an eſſential oil, ſoluble in water, and ſeparating again on the the addition of ſpirit of wine. On diſtilling it eight times with dephlogiſticated nitrous acid, we obtain a ſalt having the form of a parallelopiped, of an acid and bitter taſte, and changing the juice of violets and turnſole red. This has the properties of a true acid; combines with fixed and volatile alkalies into neutral ſalts capable of being cryſtallized; diſſolves copper, iron, biſmuth, arſenic, and cobalt. With magneſia it forms regular cryſtals, in ſome meaſure reſembling baſaltes. It is diſtinguiſhed from the acid of ſugar by not precipitating lime from its ſolution in marine acid, and by forming with magneſia a white powder ſoluble in water.

According to Neumann, all the camphor made uſe of is the produce of two ſpecies of trees: the one growing in Sumatra and Borneo, the other in Japan. Of theſe, the Japan kind is the only one brought into Europe. The tree is about the ſize of a large lime, the flowers white, and the fruit a ſmall red berry. All parts of the tree are impregnated with camphor; but the roots contain moſt, and therefore are chiefly made uſe of for the preparation of this commodity: though, in want of them, the wood and leaves are ſometimes mixed.

The camphor is extracted by diſtillation with water in large iron pots filled with earthen heads ſtuffed with ſtraw; greateſt part of the camphor concretes among the ſtraw, but paſſes down into the receiver among the water. In this ſtate it is found in ſmall bits like gray ſalt-petre, or common bay-ſalt; and requires to be purified either by a ſecond ſublimation, or by diſſolution in ſpirit of wine, filtration, and exſiccation. If the firſt method is followed, there will be ſome difficulty in giving it the form of a perfect tranſparent cake. A difficulty of this kind indeed always occurs in ſublimations; and the only way is to keep the upper part of the glaſs to ſuch a degree of heat as may keep the ſublimate in a half-melted ſtate. Dr Lewis recommends the depuration of camphor by ſpirit of wine, and then melting it into a cake in the bottom of a glaſs.

Camphor poſſeſſes conſiderable antiſceptic virtues; and is a good diaphoretic, without heating the conſtitution; with which intention it is often uſed in medicine. It is likewiſe employed in fire-works and ſeveral other arts, particularly in making varniſhes. See VARNISH.

1425 Soluble in ardent ſpirits and oil.

This ſubſtance diſſolves eaſily and plentifully in vinous ſpirits and in oils; four ounces of ſpirit of wine will diſſolve three of camphor. On diſtilling the mixture, the ſpirit riſes firſt, very little camphor coming over with it. This ſhows that camphor, however volatile it may ſeem by its ſmell, is very far from having the volatility of ether, and conſequently is improperly claſſed with ſubſtances of that kind.

1426 Empyreumatic oils.

2. *Empyreumatic Oils.* Under this name are comprehended all thoſe oils, from whatever ſubſtance obtained, which require a greater heat for their diſtillation than that of boiling water. Theſe are partially ſoluble in ſpirit of wine, and becomes more and more ſo by repeated diſtillations. The empyreumatic oils obtained from animal ſubſtances are at firſt more fetid than thoſe procured from vegetables; but by repeated diſtillations, they become exceedingly attenuated and volatile, becoming almoſt as white, thin, and volatile, as ether. They then acquire a property of acting upon the brain and nervous ſyſtem, and of allaying its irregular movements, which is common to them with all other inflammable matters when highly attenuated and very volatile; but this kind of oil is particularly recommended in epileptic and convulſive affections. It is given from 4 to 10 or 11 drops: but, though prepared with the utmoſt care, it is very ſuſceptible of loſing its whiteneſs, and even its thinneſs, by a ſhort expoſure to air; which proceeds from the almoſt inſtantaneous evaporation of its more thin and volatile parts, and from the property which the leſs volatile remainder has of acquiring colour. To avoid this inconvenience, it muſt be put, as ſoon as it is made, into very clean glaſs bottles with glaſs ſtoppers, and expoſed to the air as little as poſſible.

1427 How rectified.

The moſt important obſervations concerning the method of making the pure animal oils are, firſt to change the veſſel at each diſtillation, or at leaſt to make them perfectly clean; for a very ſmall quantity of the thicker and leſs volatile part is ſufficient to ſpoil a large quantity of that which is more rectified. In the ſecond place, Mr Beaumé has obſerved, that this operation may be greatly abridged, by taking care to receive none but the moſt volatile part in each diſtillation, and to leave a large reſiduum, which is to be neglected, and only the more volatile part to be further rectified. By this method a conſiderable quantity of fine oil may be obtained at three or four diſtillations, which could not otherwiſe be obtained at fifty or ſixty.

1428 Animal fats.

3. *Animal Fats.* Though theſe differ conſiderably from one another in their external appearance, and probably in their medicinal qualities, they afford, on a chemical analyſis, products ſimilar in quality, and differing but inconſiderably in quantity. They all yield a larger portion of oil, and no volatile ſalt; in which reſpect they differ from all other animal ſubſtances. Two ounces of hogs's lard yielded, according to Neumann, two drachms of an empyreumatic liquor, and one ounce five drachms and 50 grains of a clear brown-coloured oil of a volatile ſmell, ſomewhat like horſe-radiſh. The *caput mortuum* was of a ſhining black colour, and weighed 10 grains.

1429 Tallow.

Tallow being diſtilled in the ſame manner, two drachms of empyreumatic liquor were obtained from two ounces of it; of a clear brown oil, ſmelling like horſe-radiſh, one ounce ſix drachms and 12 grains. The remaining coal was of a ſhining black colour, and weighed 18 grains. A particular kind of acid is now found to be contained in it.

1430 Marrow.

The marrow of bones differs a little from fats, when chemically examined. Four ounces of freſh marrow, diſtilled in the uſual manner, gave over three drachms and a ſcruple of a liquor which ſmelled like tallow; two ſcruples and an half of liquor which had more of an empyreumatic and a ſouriſh ſmell; two ounces and an half of a yellowiſh-brown, butyraceous oil, which ſmelled like horſe-radiſh; and ſix drachms and an half of a blackiſh brown oil of the ſame ſmell. The *caput mortuum* weighed four ſcruples.

All animal fats, when perfectly pure, burn totally away without leaving any feces, and have no particular ſmell.
1431 Rancid oils purified.
In the ſtate in which we commonly find them, however, they are exceedingly apt to turn rancid, and emit a moſt diſagreeable and noxious ſmell; and to this they are peculiarly liable, when long kept in a gentle degree of heat. In this ſtate, too, an inflammable vapour ariſes from them, which when on fire is capable of producing exploſions. Hence, in thoſe works where large bellows are uſed, they have been often ſuddenly burſt by the inflammable vapours ariſing from the rancid oil employed for ſoftening the leather

leather. The expreſſed unctuous oils of vegetables are ſubject to the ſame changes; but from this rancidity they may all be freed moſt effectually, by the ſimple proceſs of agitating them well with water: which is to be drawn off, and freſh quantities added, till it comes off at laſt clear and inſipid, without any ill ſmell. The proper inſtrument for performing this operation in large is a barrel-churn, having in it four rows of narrow ſplit deals, from the centre to the circumference, each piece ſet at obtuſe angles to the other, in order to give different directions to the oil and water as the churn turns round, thereby to mix them more intimately. The churn is to be ſwiftly turned round for a few minutes; and muſt then be left at reſt, till the oil and water have fully ſeparated; which will be in 15 or 20 minutes, more or leſs, according to the ſize of the churn. When this water is drawn off, freſh water is to be put in, and the churn again turned round, and this continued till the oil is perfectly ſweet. If the oil and water are allowed to ſtand together for ſome days, a gelatinous ſubſtance is found between them, which is not very eaſily miſcible either with oil or water. Chalk, quicklime, and alkaline ſalts, are found alſo capable of taking off the rancidity from oils and fats; but have the inconvenience of deſtroying a part of their ſubſtance.

§ 4. *Resins and Balsams.*

These are commonly reckoned to be compoſed of an eſſential oil thickened by an acid; as the eſſential oils themſelves are found to be convertible into a ſimilar ſubſtance, by the exhalation of their more volatile parts. True reſins are generally tranſparent in a conſiderable degree, ſoluble in ſpirit of wine, and poſſeſſed of a conſiderable degree of flavour.

1432 Whence procured. Reſins are originally produced by inſpiſſating the natural juices which flow from inciſions made in the ſtems of growing vegetables, and are in that ſtate called *balſams*. The balſams may be conſidered as eſſential oils thickened by loſing ſome of their odoriferous principle, and of their fineſt and moſt volatile parts. There are ſeveral kinds of balſams, however, differ from each other only in the ſmell and degree of conſiſtence; and therefore all yield ſimilar products on diſtillation. An analyſis of turpentine therefore will be ſufficient as an example of the analyſis and natural properties of all the reſt.

1433 Turpentine Chio. The true turpentine-tree is found in Spain and the ſouthern parts of France, as well as in the iſland of Chio and in the Indies. It is a middling-ſized evergreen-tree, with leaves like thoſe of the bay, bearing purpliſh, imperfect flowers; and on ſeparate pedicles hard unctuous berries like thoſe of juniper. It is extremely reſinous; and unleſs the reſin is diſcharged, decays, produces fungous excreſcences, ſwells, burſts, and dies; the prevention of which conſiſts wholly in plentiful bleeding, both in the trunk and branches. The juice is the *Chio* or *Cyprus turpentine* of the ſhops. This ſort is quite of a thick conſiſtence, of a greeniſh white colour, clear and tranſparent, and of ſcarcely any taſte or ſmell.

1434 Venice. The kind now called *Venice turpentine*, is no other than a mixture of eight parts of common yellow or black roſin with five parts of oil of turpentine. What was originally Venice turpentine is now unknown. Neumann relates, that the Venice turpentine ſold in his country was no other than that prepared from the larix tree, which grows plentifully in ſome parts of France, as alſo in Auſtria, Tyrol, Italy, Spain, &c. Of this there are two kinds; the young trees yielding a thin limpid juice, reſembling balſam of copaiba; the older, a yellower and thicker one.

1435 Straſburg. The *Straſburg turpentine* is extracted from the ſilver-fir. Dr Lewis takes notice that ſome of the exotic firs afford balſams, or reſins, ſuperior to thoſe obtained from the native European ones; as particularly that called *balm of Gilead fir*, which is now naturalized to our own climate. A large quantity of an elegant reſinous juice may be collected from the cones of this tree: the leaves alſo, when rubbed, emit a fragrant ſmell; and yield, with rectified ſpirit, an agreeable reſinous extract.

1436 Common. The common turpentine is prepared from different ſorts of the pine; and is quite thick, white, and opaque. Even this is often counterfeited by mixtures of roſin and common expreſſed oils.

1437 Phenomena on diſtillation. All the turpentines yield a conſiderable proportion of eſſential oil. From ſixteen ounces of Venice turpentine, Neumann obtained, by diſtillation with water, four ounces and three drachms of oil. The ſame quantity diſtilled, without addition, in the heat of a water-bath, gave but two ounces and an half; and from the reſiduum treated with water, only an ounce could be obtained. The water remaining in the ſtill is found to have imbibed nothing from the turpentine; on the contrary, the turpentine is found to imbibe part of the water; the reſiduum and the oil amounting to a full ounce on the pound more than the turpentine employed. When turpentine is diſtilled or boiled with water till it becomes ſolid, it appears yellowiſh; when the proceſs is further continued, of a reddiſh brown colour: in the firſt ſtate, it is called *boiled turpentine*; and in the latter, *colophony*, or *roſin*.

On diſtilling ſixteen ounces of turpentine in a retort with an open fire, increaſed by degrees, we obtain firſt four ounces of a limpid colourleſs oil; then two ounces and two drachms of a yellowiſh one; four ounces and three drachms of a thicker yellow oil; and two ounces and one drachm of a dark browniſh red empyreumatic oil, of the conſiſtence of balſam, and commonly called *balſam of turpentine*.

1438 Eſſential oil difficult of ſolution. The limpid eſſential oil called *ſpirit of turpentine*, is exceedingly difficult of ſolution in ſpirit of wine; tho' turpentine itſelf diſſolves with great eaſe. One part of the oil may indeed be diſſolved in ſeven parts of rectified ſpirit; but on ſtanding for ſome time, the greateſt part of the oil ſubſides to the bottom, a much greater proportion of ſpirit being requiſite to keep it diſſolved.

1439 Benzoin. 2. *Benzoin.* This is a very brittle browniſh reſin, of an exceedingly fragrant ſmell. The tree which produces benzoin is a native of the Eaſt Indies; particularly of Siam and the iſland of Sumatra. It is never permitted to exceed the ſixth year; being, after this time, unfit for producing the benzoin. It is then cut down, and its place ſupplied by a young tree raiſed commonly from the fruit. One tree does not yield above three pounds of benzoin.

A tree ſuppoſed to be the ſame with that which affords ſords benzoin in the Eaſt Indies, is plentiful alſo in Virgina and Carolina; from whence it has been brought into England, where it grows with vigour in the open ground. The bark and the leaves have the ſmell of benzion; and yield with rectified ſpirit a reſin of the ſame ſmell; but no reſin has been obſerved to iſſue from it naturally in England, nor has any benzoin been collected from it in America.

1440 Soluble in ſpirit of wine. Benzoin diſſolves totally in ſpirit of wine into a blood-red liquor, leaving only the impurities, which commonly amount to no more than a ſcruple on an ounce. To water, it gives out a portion of ſaline matter of a peculiar kind, volatile and ſublimable in the fire. See 984 *et ſeq*.

The principal uſe of reſins is in the making of lacquers, varniſhes, &c. See VARNISH.

§ 5. *Bitumens.*

THESE are inflammable mineral bodies, not ſulphureous, or only caſually impregnated with ſulphur. They are of various degrees of conſiſtency; and ſeem, in the mineral kingdom, to correſpond with the oils and reſins in the vegetable.

1441 Origin of bitumens. Concerning the origin of bitumens, chemiſts are not at all agreed. Some chemical writers, particularly Mr Macquer, imagine bitumens to be no other than vegetable reſins altered in a peculiar manner by the admixture of ſome of the mineral acids in the earth; but Dr Lewis is of a contrary opinion, for the following reaſons.

"Mineral bitumens are very different in their qualities from vegetable reſins; and, in the mineral kingdom, we find a fluid oil very different from vegetable oils. The mineral oil is changed by mineral acids into a ſubſtance greatly reſembling bitumens; and the vegetable oils are changed by the ſame acids into ſubſtances greatly reſembling the natural reſins.

"From bitumens we obtain, by diſtillation, the mineral oil, and from reſins the vegetable oil, diſtinct in their qualities as at firſt. Vegetable oils and reſins have been treated with all the known mineral acids; but have never yielded any thing ſimilar to the mineral bitumens. It ſeems, therefore, as if the oily products of the two kingdoms were eſſentially and ſpecifically different. The laws of chemical inquiries at leaſt demand, that we do not look upon them any otherwiſe, till we are able to produce from one a ſubſtance ſimilar to the other. When this ſhall be done, and not before, the preſumption that nature effects the ſame changes in the bowels of the earth, will be of ſome weight."

1442 Naphtha. There is a perfectly fluid, thin bitumen, or mineral oil, called *naphtha*, clear and colourleſs as cryſtal; of a ſtrong ſmell; extremely ſubtile; ſo light as to ſwim on all known liquors, ether perhaps excepted: ſpreading to a vaſt ſurface on water, and exhibiting rainbow colours; highly inflammable: formerly made uſe of in the compoſition of the ſuppoſed inextinguiſhable greek fire.

1443 Petroleum. Next to this in conſiſtence is the *oleum petra*, or *petroleum*: which is groſſer and thicker than naphtha, of a yellowiſh, reddiſh, or browniſh colour; but very light, ſo as to ſwim even on ſpirit of wine. By diſtillation, the petroleum becomes thinner and more ſubtile, a groſs matter being left behind; it does not, however, eaſily ariſe, nor does it totally loſe its colour by this proceſs, without particular managements or additions.

Both naphtha and petroleum are found plentifully in ſome parts of Perſia, trickling through rocks or ſwimming on the ſurface of waters. Kempfer gives an account of two ſprings near Baku; one affording naphtha, which it receives in drops from ſubterraneous veins; the other, a blackiſh and more fetid petroleum, which comes from Mount Caucaſus. The naphtha is collected for making varniſhes; the petroleum is collected in pits, and ſent to different places for lamps and torches.

Native petrolea are likewiſe found in many different places, but are not to be had in the ſhops; what is ſold there for petroleum, being generally oil of turpentine coloured with alkanet root. The true naphtha is recommended againſt diſorders of the nerves, pains, cramps, and contractions of the limbs, &c. but genuine naphtha is rarely or never brought to this country.

There are ſome bitumens, ſuch as amber, ambergris, pit-coal, and jet, perfectly ſolid; others, ſuch as Barbadoes tar, of a middle conſiſtence between fluid and ſolid. Turf and peat are likewiſe thought to belong to this claſs.

1444 Amber. 1. *Amber*. This ſubſtance melts, and burns in the fire, emitting a ſtrong peculiar ſmell. Diſtilled in a ſtrong heat, it yields a phlegm, an oil, and a particular ſpecies of acid ſalt. The diſtillation is performed in earthen or glaſs retorts, frequently with the addition of ſand, ſea-ſalt, coals, &c. which may break the tenacity of the melted maſs, ſo as to keep it from ſwelling up, which it is apt to do by itſelf. Theſe additions, however, make a perceptible difference in the produce of the diſtillation: with ſome the ſalt proves yellowiſh and dry; with others, browniſh or blackiſh, and unctuous or ſoft like an extract: with ſome, the oil is throughout of a dark brown colour; with others, it proves externally green or greeniſh; with elixated aſhes, in particular, it is of a fine green. The quantity of oil and phlegm is greateſt when coals are uſed, and that of ſalt when ſea ſalt is uſed.

1445 Moſt advantageouſly diſtilled without addition. The moſt advantageous method of diſtilling amber, however, is without any addition; and this is the method uſed in Pruſſia, where the greateſt quantities of ſalt and oil of amber are made. At firſt a phlegmatic liquor diſtils; then a fluid oil; afterwards one that is thick and more ponderous; and laſt of all, an oil ſtill more ponderous along with the ſalt. In order to collect the ſalt more perfectly, the receiver is frequently changed; and the phlegm, and light oil, which ariſe at firſt, are kept by themſelves. The ſalt is purified, by being kept ſome time on bibulous paper, which abſorbs a part of the oil: and changing the paper as long as it receives any oily ſtain. For the further depuration as well as the nature of this ſalt, ſee SUCCINUM.

1446 Ambergris. 2, *Ambergris*. This concrete, which is only uſed as a perfume, yields, on diſtillation, products of a ſimilar nature to that of amber, excepting that the volatile ſalt is in much leſs quantity. See AMBERGRIS.

1447 Pit-coal. 3. *Pit-coal*. See the articles COAL and LITHAN-

THRAX. This ſubſtance yields by diſtillation, according to the tranſlator of the Chemical Dictionary, 1. phlegm, or water; 2. a very acid liquor; 3. a thin oil, like naphtha; 4. a thicker oil, reſembling petroleum, which falls to the bottom of the former, and which riſes with a violent fire; 5. an acid, concrete ſalt; 6. *an uninflammable earth* (we ſuppoſe he means a piece of charred coal, or cinder) remains in the retort. The fluid oil obtained from coals is ſaid to be exceedingly inflammable, ſo as to burn upon the ſurface of water like naphtha itſelf.

1448 Peat. 4. *Peat.* There are very conſiderable differences in this ſubſtance, proceeding probably from the admixture of different minerals: for the ſubſtance of peat is plainly of vegetable origin; whence it is found to anſwer for the ſmelting of ores, and the reduction of metallic calces, nearly in the ſame manner as coals of wood. Some ſorts yield, in burning, a very diſagreeable ſmell, which extends to a great diſtance; whilſt others are inoffenſive. Some burn into grey or white, and others into red, ferruginous aſhes. The aſhes yield, on elixation, a ſmall quantity of alkaline, and ſome neutral ſalts.

1449 Phenomena on diſtillation. The ſmoke of peat does not preſerve or harden fleſh like that of wood; and the ſoot into which it condenſes is more apt to liquefy in moiſt weather. On diſtilling peat in cloſe veſſels, there ariſes a clear inſipid phlegm: an acid liquor, which is ſucceeded by an alkaline one; and a dark-coloured oil. The oil has a very pungent taſte, and an empyreumatic ſmell; leſs fetid than that of animal ſubſtances, but more ſo than that of mineral bitumens. It congeals, in the cold, into a pitchy maſs, which liquefies in a ſmall heat: it readily catches fire from a candle; but burns leſs vehemently than other oils, and immediately goes out upon removing the external flame. It diſſolves almoſt totally in rectified ſpirit of wine, into a dark, browniſh-red liquor.

§ 6. CHARCOAL.

1450 Differences between the coals of different ſubſtances. THIS is the form to which all inflammable matters are reducible, by being ſubjected to the moſt vehement action of fire in cloſe veſſels; but though all the coals are nearly ſimilar to one another in appearance, there is nevertheleſs a very conſiderable difference among them as to their qualities. Thus the charcoal of vegetables parts with its phlogiſton very readily, and is eaſily reducible to white aſhes: charred pit-coal, or, as it is commonly called, *coak*, much more difficultly; and the coals of burnt animal ſubſtances, far more difficultly than either of the two. Mr Macquer acquaints us, that the coal of bullock's blood parts with its phlogiſton with the utmoſt difficulty. He kept it very red, in a ſhallow crucible ſurrounded with charcoal, for ſix hours and more, ſtirring it conſtantly that it might be all expoſed to the air, without being able to reduce it to white, or even grey aſhes. It ſtill remained very black, and full of phlogiſton. The coals of pure oils, or concrete oily ſubſtances, and ſoot, which is a kind of coal raiſed during the inflammation of oils, are as difficultly burnt as animal coals. Theſe coals contain very little ſaline matter, and their aſhes furniſh no alkali. Theſe coals, which are ſo difficultly burnt, are alſo leſs capable of inflaming with nitre than others more combuſtible; and ſome of them, in a great meaſure, reſiſt even the action of nitre itſelf.

1451 Charcoal perfectly refractory. Charcoal is the moſt refractory ſubſtance in nature; no inſtance having been known of its ever being melted, or ſhowing the leaſt diſpoſition to fuſion, either by itſelf, or with additions: hence, charcoal is found to be the moſt proper ſupport for ſuch bodies as are to be expoſed to the focus of a large burning glaſs. The only true ſolvent of charcoal is *hepar ſulphuris*. By the violent heat of a burning-glaſs, however, it is found to be entirely diſſipable into inflammable air, without having any reſiduum. See AEROLOGY, nº 129. and CHARCOAL.

The different ſubſtances mixed with different coals, render ſome kinds of charcoal much leſs fit to be uſed in reviving metals from their calces, or in ſmelting them originally from their ores. The coals of vegetable ſubſtances are found to anſwer beſt for this purpoſe. See METALLURGY.

SECT. V. *Vegetable and Animal Subſtances.*

THE only ſubſtances afforded by vegetables or animals, which we have not yet examined, are the mucilaginous, or gummy; and the colouring parts obtained by infuſion, or boiling in water; and the calculous concretions found in the bodies of animals, chiefly in the human bladder. The colouring matter is treated of under the article *COLOUR-Making*, to which we refer; and in this ſection ſhall only conſider the nature of the others.

§ 1. *MUCILAGE or GUM.*

1452 Mucilage. THE mucilage of vegetables is a clear tranſparent ſubſtance, which has little or no taſte or ſmell, the conſiſtence of which is thick, ropy, and tenacious, when united with a certain quantity of ſuperabundant water. It is entirely and intimately ſoluble in water, and contains no diſengaged acid or alkali.

When mucilage is diſſolved in a large quantity of water, it does not ſenſibly alter the conſiſtence of the liquor: but, by evaporation, the water grows more and more thick; and, at laſt, the matter acquires the conſiſtence of gum arabic, or glue; and this without loſing its tranſparency, provided a heat not exceeding that of boiling water has been uſed.

1453 Phenomena on diſtillation. Gums, and ſolid mucilages, when well dried and very hard, are not liquefied in the fire like reſins, but ſwell, and emit many fumes; which are, at firſt, watery: then oily, fuliginous, and acrid. Diſtilled in cloſe veſſels, an aqueous acid liquor comes over along with an empyreumatic oil, as from other vegetable ſubſtances; a conſiderable quantity of coal remains, which burns to aſhes with difficulty.

Mucilages and gums are not ſoluble either by oils, ſpirit of wine, alkalies, or acids, except in ſo far as they diſſolve in theſe liquors by means of the water in which the alkali or acid are diſſolved. They are, however, the moſt effectual means of uniting oil with water. Three parts of mucilage, poured upon one part of oil, will incorporate with it by trituration or agitation; and the compound will be ſoluble in water. Vegetable gums are uſed in medicine, as well as the mechanic arts; but the particular uſes to which each of them is applicable, will be mentioned under the name of each particular gum.

1454 Jelly and glue.

The mucilage obtained from animal ſubſtances, when not too thick, is called *jelly*, or *gelatinous matter*; when further inſpiſſated, the matter becomes quite ſolid in the cold, and is called *glue*. If the evaporation is ſtill further continued, the matter acquires the conſiſtence of horn.

This gelatinous ſubſtance ſeems to be the only true animal one; for all parts of the body, by long continued boiling, are reducible to a jelly, the hardeſt bones not excepted. Animal jelly, as well as vegetable mucilage, is almoſt inſipid and inodorous; but, though it is difficult to deſcribe the difference betwixt them when apart, it is very eaſily perceived when they are both together. Acids and alkalies, particularly the latter, diſſolve animal jellies with great eaſe; but the nature of theſe combinations is not yet underſtood. The other properties of this ſubſtance are common to it with the vegetable gums, except only that the animal mucilage forms a much ſtronger cement than any vegetable gum: and is therefore much employed for mechanical purpoſes, under the name of *glue*. See Glue and Isinglass.

§ 2. *Of the* Human Calculus.

1455 Scheele's experiments on the human calculus.

This ſubſtance has been repeatedly examined by the moſt eminent chemiſts. Mr Scheele, as has been related nº 982, *et ſeq.* has been able to extract an acid from it. His account of it in other reſpects is to the following purpoſe.

1. All the calculi examined, whether flat and poliſhed, or rough and angular, were of the ſame nature, and conſiſted of the ſame conſtituent parts.

2. The diluted vitriolic acid has no effect upon the calculus, but the concentrated acid diſſolves it, and by abſtraction from it is converted into the ſulphureous kind, leaving a black coal behind.

3. Neither diluted nor concentrated ſpirit of ſalt had any effect upon it.

4. By means of nitrous acid, a new one was produced, and which is poſſeſſed of ſingular qualities, as already mentioned.

5. The ſolution of calculus in nitrous acid is not precipitated by ponderous earth, nor are metallic ſolutions ſenſibly altered by it.

6. It is not precipitated by alkalies, but grows ſomewhat yellower by a ſuperabundance of the latter. In a ſtrong digeſting heat the liquor becomes red, and tinges the ſkin of the ſame colour. It precipitates green vitriol of a black colour; vitriol of copper, green; ſilver, grey; corroſive ſublimate, zinc, and lead, white.

7. The ſolution is decompoſed by lime-water, and lets fall a white precipitate, ſoluble in the muriatic acid without any efferveſcence: but though there be an exceſs of precipitate, the liquor ſtill remains acid; which happens alſo with animal earth, and that of fluor diſſolved in the ſame acids. On evaporation to dryneſs, the matter will at laſt take fire; but when heated only to a dull red heat in a cloſe crucible, it grows black, ſmells like burnt alum, and efferveſces with acids; being convertible before the blow-pipe into quicklime.

8. Neither this ſolution, nor the alkaline mixture, is changed by the acid of ſugar.

9. The calculus is not changed by acid of tartar, though it is diſſolved even in the cold by alkali, when reduced to ſuch a ſtate of cauſticity as not to diſcover the leaſt mark of aerial acid. The ſolution is yellow and taſtes ſweetiſh; and is precipitated by all the acids, even by the aerial. It decompoſes metallic ſolutions, but does not precipitate lime-water; and a ſmell of volatile alkali is produced by a little ſuperabundance of alkali in the ſolution. Dry volatile alkali has no effect upon the calculus; but cauſtic volatile alkali diſſolves it, though a pretty large quantity is required for this purpoſe.

10. Calculus is likewiſe diſſolved by digeſting in lime-water; and for this purpoſe four ounces of lime-water are required to twelve grains of the calculus; but the latter is partly precipitated by adding acids to the ſolution. By this union the lime-water loſes its cauſtic taſte.

11. Calculus is alſo diſſolved entirely by pure water; but for this purpoſe a large quantity of fluid is required. Eight grains of calculus in fine powder will diſſolve by boiling for a ſhort time in five ounces of water. The ſolution reddens tincture of lacmus, but does not precipitate lime-water; and when it grows cold, the greateſt part of the calculus ſeparates in fine cryſtals.

12. On diſtilling a drachm of calculus in a glaſs retort, a volatile liquor was obtained reſembling hartſhorn, but without any oil; and in the neck of the veſſel was a brown ſublimate. On heating the retort thoroughly red hot, and then leaving it to cool, a black coal was left, weighing 12 grains, which retained its black colour on a red hot iron in the open air. The ſublimate, which had ſome marks of fuſion, weighed 28 grains, and became white by a new ſublimation. Its taſte was ſomewhat ſouriſh, but it had no ſmell; it was ſoluble both in water and in ſpirit of wine; but a larger quantity of ſpirit than of water was requiſite for this purpoſe. It did not precipitate lime-water, and ſeemed in ſome reſpects to agree with the ſal ſuccini.

1456 His concluſions concerning its compoſition.

From theſe experiments our author concludes, that the human calculus is neither calcareous nor gypſeous; but conſiſts of an oily, dry, volatile acid, united with ſome gelatinous matter. The calculus is an oily ſalt, in which the acid prevails a little, ſince it is ſoluble in pure water; and this ſolution reddens the tincture of lacmus. That it contains phlogiſton, appears from its ſolution in cauſtic alkalies and lime-water, but eſpecially from the effect of the nitrous acid, by which it acquires quite different properties than from ſolution in alkalies; nor can it be precipitated from this ſolution. The animal gelatinous ſubſtance appears on diſtillation, by which a liquor is obtained reſembling ſpirit of hartſhorn, and a fine coal is left behind.

1457 Is found univerſally in urine.

13. Calculus is found diſſolved in all urine, even in that of children. On evaporating four kannes of freſh urine to two ounces, a fine powder is depoſited as it cools, and a part firmly adheres to the glaſs. The precipitated powder readily diſſolves in a few drops of cauſtic fixed alkali; and has in other reſpects all the properties of calculus. Of the ſame nature is the lateritious ſediment depoſited by the urine of thoſe who labour under an ague. Mr Scheele ſuſpected at firſt, that there was in this urine ſome unknown menſtruum which kept ſuch a quantity of powder diſſolved, and which might afterwards evaporate by expoſure to the air; but altered his opinion on perceiving that the ſediment was equally depoſited in cloſe veſſels.

14. All urine contains ſome animal earth combined with phoſphoric acid; by the ſuperabundance of which acid,

1458 Why freſh urine reddens lacmus.

acid, the earth is kept diſſolved; and by reaſon of this ſuperabundant acid freſh urine communicates a red colour to lacmus. By ſaturation with cauſtic volatile alkali a white powder is precipitated; of which three drachms and an half are obtained from four kannes of urine. It is ſoluble in nitrous acid; and on adding the vitriolic, ſome gypſum is precipitated. On evaporating the nitrous acid, another remained, which precipitated lime-water, and when mixed with lamp-black, afforded phoſphorus by diſtillation; whence it is evident, that the white powder juſt mentioned contained lime and phoſphoric acid.

1459 Salts, &c. contained in urine.

15. From theſe experiments Mr Scheele concludes, that all urine contains, beſides the ſubſtances already known (*viz.* ſal ammoniac, common ſalt, digeſtive ſalt, Glauber's ſalt, microcoſmic ſalt, ſal perlatum, and an oily extractive matter), a concrete acid, or that of calculus, and animal earth. It is alſo remarkable, that the urine of the ſick is more acid, and contains more animal earth than that of healthy perſons. With regard to the ſal perlatum, it was afterwards diſcovered by Mr Scheele not to be a peculiar acid, but only a phoſphoric acid diſguiſed by a ſmall quantity of foſſil alkali united with it. The analyſis is confirmed by syntheſis; for, by combining foſſil alkali with phoſphoric acid, our author obtained a true perlate acid.

1460 Bergman's account of the calculus.

In a ſupplement to Mr Scheele's diſſertation on the calculus, Mr Bergman obſerves, that he could not ſucceed in diſſolving it entirely either in pure water or in the nitrous acid, though the undiſſolved part was the leſs in proportion to the fineneſs of the powder to which the calculus was reduced. The undiſſolved part appears moſt conſpicuous, when ſmall pieces, or ſmall calculi of a few grains weight only, are put into a ſuperabundant quantity of menſtruum, and kept in a degree of heat very near to that which makes water boil. Here it will be obſerved, that the greateſt part of the piece is diſſolved; but that at the ſame time ſome ſmall white ſpongy particles remain, which are not affected either by water, ſpirit of wine, acids, or cauſtic volatile alkali. If the liquor be made fully to boil, theſe particles divide into white rare flocculi, and become almoſt imperceptible, but without any entire diſſolution. Mr Bergman could not collect a ſufficient quantity of them to determine their nature with accuracy; only he obſerved, that when expoſed to a ſtrong heat, they were reduced to a coal which burns ſlowly to aſhes, and is not ſoluble in diluted nitrous acid.

"When calculus veſicae (ſays he) is diſſolved in nitrous acid, no precipitation enſues on adding the acid of ſugar; whence one is readily induced to conclude, that there is no calcareous earth preſent, becauſe this experiment is the ſureſt way to diſcover it. But I have found, in the variety of experiments concerning elective attractions, that the addition of a third ſubſtance, inſtead of diſuniting two already united, often unites both very cloſely. That the ſame thing happens here I had the more reaſon to believe, becauſe the acid of ſugar contains ſome phlogiſtic matter, though of ſuch a ſubtle nature, that, on being burned, it does not produce any ſenſible coal; and the event of my experiment has ſhown, that I was not miſtaken in my conjecture. In order to aſcertain this point, I burned coals of the calculus to aſhes, which were quite white, and ſhowed in every reſpect the ſame phenomena as lime; cauſed ſome efferveſcence during their ſolution in acids, united with vitriolic acid into gypſum, were precipitated by the acid of ſugar, and were partly ſoluble in pure water, &c. Notwithſtanding this, there remains about one-hundredth part of the aſhes inſoluble in aquafortis; being the remainder of the ſubſtance abovementioned, which, together with the concrete acid, conſtitutes the calculus. If the calculus be diſſolved in nitrous acid, the ſolution filtered and evaporated to dryneſs, and the dry maſs calcined to whiteneſs, a calcareous powder is thus likewiſe obtained."

1461 Calcareous earth ſeparated from it by vitriolic acid.

As pure vitriolic acid contains no phlogiſton, our author ſuppoſed, that by dropping it, in its concentrated ſtate, into a ſolution of calculus in nitrous acid, the calcareous earth, if any exiſted in it, would be diſcovered. In this he was not diſappointed; for when the ſolution was ſaturated, ſome ſmall cryſtals were thus immediately ſeparated. Theſe, on examination, were found to be gypſum; and, after being diſſolved in diſtilled water, were precipitated by acid of ſugar. When the ſolution of calculus was very much diluted, no change appeared at firſt on the addition of oil of vitriol; but after a little evaporation, the abovementioned cryſtals began to appear. Some calculi of the bladder or kidneys at leaſt certainly contain lime, but ſeldom more than one half in an hundred parts, or one in 200 parts.

By the aſſiſtance of heat, concentrated vitriolic acid diſſolves the calculus with efferveſcence, and the ſolution is of a dark brown colour. On adding a little water, a kind of coagulation takes place; but by adding more, the liquor again becomes clear, and aſſumes a yellowiſh colour. Mr Bergman agrees with Mr Scheele in ſuppoſing that the muriatic acid has no effect upon the calculus; but he is in no doubt whether it may not extract ſome part of the calcareous earth.

1462 Red colour of the nitrous ſolution accounted for.

The red colour aſſumed by the ſolution of calculus in aquafortis is remarkable. A ſaturated ſolution diſcovers no ſmell of nitrous acid, and if evaporated by itſelf in a large open veſſel, the liquor aſſumes at laſt a deep red colour, and ſcarcely contains any nitrous acid: for, on the one hand, paper tinged with lacmus ſcarce ſhows any redneſs; and, on the other, the colour is deſtroyed irrecoverably by the addition of any acid. By quick evaporation the ſolution at laſt ſwells into innumerable bubbles; the foam grows redder and redder, and at laſt becomes dark red after it is quite dry. This dry maſs communicates its colour to a much larger quantity of water than before, and diſſolves very readily in all acids, even ſuch as have no action on the calculus; but they entirely deſtroy the colour, and that the more quickly in proportion to their degree of ſtrength; even alum has this effect on account of the ſmall quantity of looſe acid it contains. Cauſtic alkalies alſo diſſolve the colouring matter, and deſtroy it, but more ſlowly.

Our author endeavours to account for this red colour produced by the nitrous acid, from the peculiar nature of that acid and the effect it has upon phlogiſton. In order to obtain it, a proportionable quantity of acid muſt be made uſe of, and it ought to be diluted, that there may be no danger of going beyond the neceſſary limit. If too much be uſed, it will not produce the proper effect; but, by reaſon of its ſuperabundance, more or leſs, or even the whole, will be deſtroyed in proportion to the quantity. By pouring it in an undiluted ſtate on powdered calculus, it is converted in a few moments into mere foam. The acid of calculus is the more eaſily ſeparated from the aquafortis by evaporation, as the latter is rendered more volatile by the inflammable particles of the former: alkali added to them both united does not produce any precipitation; a circumſtance generally obſerved where two acids are united. In this caſe both the acids unite with the alkali, according to the different laws of their attraction. The red maſs obtained after deſiccation is, however, very different from the concentrated acid, ſuch as is contained in the calculus; for it is of a darker colour, and very deliqueſcent: the leaſt particle gives a roſe colour to a very conſiderable quantity of water; but the muriatic and other ſtrong acids always certainly deſtroy it; and, in a longer or ſhorter time, produce a colourleſs ſolution. This remarkable change depends, according to our author, more on the action of the nitrous acid upon the inflammable part, than upon any thing remaining behind.—Such red ſpots as are produced upon the ſkin by the ſolution, are likewiſe produced upon bones, glaſs, paper, and other ſubſtances; but more time is required for their becoming viſible, though this too may be a little accelerated by means of heat.

1463
Experiments of Mr Higgins on this ſubject.

The following is an abſtract of Mr Higgins's experiments upon this ſubject.

1. Eight hundred and forty grains of dry and well powdered calculus were introduced into a glaſs retort. It was taken from a laminated ſtone with a ſmall nucleus, which was likewiſe laminated. The outward cruſt appeared very porous, but increaſed in denſity towards the centre. By the application of heat, an elaſtic fluid was firſt ſlowly extricated; and which, on examination, appeared to be compoſed of equal parts of fixed and phlogiſticated air. The laſt portions came over very faſt, and were attended with an urinous ſmell; and, by continuing the diſtillation, it became evident that fixed and alkaline air came over together without forming any union, as they ought, on the common principles of chemiſtry, to have done; though our author is at a loſs to know why they did not unite, unleſs they were prevented by the ſmall quantity of inflammable air which came over along with them.

From the beginning of the 10th meaſure, a black, charry, and greaſy matter began to line the conical tube and air-veſſel adapted to the retort; and as the proceſs went on, the proportion of alkaline air decreaſed, while that of the inflammable air was augmented, until towards the end, when the laſt nine meaſures were all inflammable; after which no more would come over, though the retort was urged with a white heat. On breaking the diſtilling veſſel, a black powder weghing 95 grains was found in it. On digeſting this for an hour in ten ounces of diſtilled water, and then filtering and evaporating it to two ounces, a yellowiſh powder was precipitated, but no cryſtals were formed after ſtanding a whole night. This powder was then ſeparated by filtration, and the liquor evaporated to one ounce; during which time more powder was precipitated. It was then filtered a ſecond time, and the liquor evaporated to half an ounce; when it began to depoſit a white powder, and to emit a ſubacid aſtringent vapour, not unlike that of vitriolic acid. This white precipitate, when waſhed and dried, amounted only to one grain, had a ſhining appearance, and felt very ſoft, not unlike mica in powder. It was not changed, but rather looked whiter by expoſing it to a fierce heat for ten minutes. It diſſolved in diſtilled water without being precipitated by cauſtic volatile alkali. Mineral alkali, acid of ſugar, and nitrated terra ponderoſa, rendered the ſolution turbid; whence our author inferred, that the powder in queſtion was ſelenite.

After the ſeparation of this powder, the remaining ſolution was evaporated to dryneſs with a gentle heat. During the evaporation it continued to emit ſubacid vapours, leaving eleven grains of powder of a dirty yellow colour, having an aluminous taſte. To this powder he added as much diſtilled water as was nearly ſufficient to diſſolve it; after which it was ſet by for three weeks. At the expiration of this term ſeveral ſmall, tranſparent, and cubical cryſtals appeared on the ſide of the veſſel above the ſurface of the ſolution; and theſe likewiſe had an aluminous taſte. The whole was then diſſolved in diſtilled water, and the ſolution filtered. Acid of ſugar produced no change in the liquor for at leaſt five minutes, but an immediate cloudineſs took place on a mixture with volatile alkali; and on filtering the liquor it was again rendered turbid by mineral alkali, though the cauſtic alkali already predominated. Nitrated terra ponderoſa threw down a copious precipitate, and Pruſſian alkali diſcovered a ſmall quantity of iron. This aluminous ſolution left a yellow ſubſtance on the filter; which, when collected and dried, weighed only half a grain: it diſſolved without efferveſcence in nitrous acid; acid of ſugar cauſed no precipitation, but cauſtic volatile alkali threw down a precipitate which diſſolved in diſtilled water. This ſolution was rendered turbid by the acid of ſugar and muriated terra ponderoſa, but no effect was produced by cauſtic volatile alkali or lime-water.

The yellow powder firſt depoſited by the ſolution weighed two grains and a half, and by expoſure to a ſtrong heat acquired a deep orange colour. On digeſtion with diſtilled water, the inſoluble part was reduced to three-fourths of a grain, and appeared to be iron: while the ſoluble part was found to be nothing elſe but gypſum. Our author, however, is of opinion, that this iron is impregnated with a ſmall portion of vitriolic acid, though not in ſuch quantity as to render it ſoluble.

The charred matter remaining in the retort was reduced by lixiviation with water to 80 grains. Theſe were calcined with a red heat in an open fire, but could not be reduced to a grey powder in leſs than three quarters of an hour. When thoroughly calcined and cold, it weighed only 21 grains, which communicated to hot diſtilled water a limy taſte, and gave it the property of turning ſyrup of violets green. Diluted vitriolic acid had no effect upon it, but it was rendered turbid by aerated volatile alkali and acid of ſugar. The remainder when well dried weighed 16 grains, which diſſolved in nitrous acid at firſt with a little efferveſcence; and when this ceaſed, the ſolution went on very ſlowly, until the whole was taken up. Acid of ſugar made no change in the liquid, but the whole was precipitated by cauſtic volatile alkali. Pruſſian alkali threw down a grain, or perhaps more, of

blue;

1464 His account of its component parts.

blue; the precipitate digeſted with diſtilled vinegar loſt a grain and an half, which was thrown down by cauſtic volatile alkali. The inſoluble part being waſhed and digeſted in diſtilled water for half an hour, was partly diſſolved; the ſolution was not affected by cauſtic volatile alkali, but acid of ſugar and nitrated terra ponderoſa cauſed an immediate cloudineſs. Seven grains and an half of the powder, which was inſoluble both in acetous acid and diſtilled water, were readily taken up by diluted vitriolic acid, and precipitated by cauſtic volatile alkali: the 16 grains laſt treated, therefore, appeared to contain, of clay 7½ grains; of ſelenite, ſix grains; magneſia, one and a half; and of iron, one grain. The proportions of the different ingredients in the whole calculus, therefore, according to Mr Higgins, are as follows:

	Grains.
Iron - -	2½
Selenite - -	11
Clay - -	7½
Alum - -	8
Pure calcareous earth -	5
Aerated magneſia - -	1½
Charry combuſtible ſubſtance -	59
In all	94½

1465 Experiments on the ſublimate ariſing from it on diſtillation.

In this experiment, a darkiſh yellow ſublimate adhered to the neck of the retort, the inner part next the retort more compact, but the reſt of a lamellar ſpongy texture. This ſublimate, when carefully collected, was found to weigh 425 grains, and readily diſſolved in eight ounces of hot diſtilled water. A coaly ſubſtance was ſeparated from this ſolution by filtration, which, when waſhed and dried, weighed ten grains, and when expoſed to a red heat burned with a greeniſh flame, emitting white fumes, which ſmelled like vitriolic ſal ammoniac: the reſiduum after calcination weighed half a grain, and was of a whitiſh colour: appearing inſoluble in diſtilled water, but diſſolving with effervescence in nitrous acid. Acid of ſugar cauſed a very ſmall precipitation, which did not take place until the mixture had ſtood for ſome time; but cauſtic volatile alkali inſtantly threw down a precipitate, which was taken up, when waſhed, by the acetous acid. The quantity was too ſmall to be examined with greater accuracy; but it ſeemed to poſſeſs the properties of magneſia. The ſaline ſolution had the colour of ſmall beer; and, when evaporated to two ounces, did not depoſit any ſediment, or yield any cryſtals. The black matter with which the conical tube and air veſſel were lined, weighed 28 grains, and adhered ſo faſt to the glaſs, that it was impoſſible to collect the whole from the fragments of the glaſs. When diſſolved in diſtilled water and filtered, four grains of coals, ſimilar to that obtained from the former, were procured; but no ſigns of cryſtallization were obſerved after evaporation to one ounce, and ſuffering the liquor to ſtand all night.

By this treatment the ſolution acquired the conſiſtence of treacle; ſo that it was plainly not cryſtallizable, and therefore its analyſis was plainly to be attempted after a different method. It was now put into a tubulated glaſs retort, together with ſix ounces of diſtilled water to waſh it down. By diſtillation in a ſand-bath three ounces of water were procured, which differed in nothing from common diſtilled water, but in being coloured with a ſmall quantity of the ſolution from the neck of the retort. On changing the receiver, about half an ounce of liquor of the ſame kind came over, after which the diſtillation began to be attended with an urinous ſmell. This continued barely perceptible for ſome time; but when about an ounce and an half had paſſed over, it became ſo very pungent, that our author could no longer doubt of its being in a cauſtic ſtate. A ſmall quantity of mild alkali, however, adhered to the lower part of the neck of the retort, ſome of which was waſhed down by the diſtillation; ſo that the proportions betwixt the two could not be aſcertained. The volatile alkaline ſolution in the retort had the colour of ſpirit of hartſhorn, and like it became darker coloured by the contact of air; on account of the evaporation of part of the alkali, and the reſt becoming leſs capable of ſuſpending the coaly matter mixed with it.

After all the liquor had paſſed over, and nothing remained in the retort but a ſmall quantity of black matter, the fire was raiſed; and, as the heat increaſed, this black ſubſtance acquired a white colour, with a kind of arrangement on the ſurface, which was occaſioned by the heat applied to the bottom of the retort being only ſufficient to raiſe the ſalt to the top of the matter in the retort; but as the ſand became nearly red-hot, white fumes began to appear, which condenſed on the upper part of the retort, and a little way down the neck. The proceſs laſted until the matter was nearly red-hot, when the fumes ceaſed, and nothing more paſſed over. The ſublimate, when collected, was found to weigh 72 grains, a black porous brittle ſubſtance remaining on the bottom of the retort, which weighed 12 grains. This reſiduum, when expoſed to a ſtrong heat, emitted white fumes, with a ſlight alkaline ſmell; by which proceſs it was reduced, with very little appearance of combuſtion, to a grey powder weighing three grains, which was accidentally loſt.

Five grains of this purified ſublimate, mixed with as much quicklime, emitted no ſmell of volatile alkali; and, when thrown upon a red-hot iron, emitted white fumes. The ſame effect was produced by a mixture of equal quantities of vegetable alkali and ſublimate. The remainder, conſiſting of 62 grains, was divided into two equal parts; the one of which was mixed with two ounces of diſtilled water, and on the other was poured 60 grains of vitriolic acid diluted with half an ounce of water. Theſe two mixtures being ſuffered to remain for ſix weeks, ſeemed to be but little acted upon. That with vitriolic acid was then put into a ſmall matraſs, and boiled on ſand for half an hour with two ounces of diſtilled water, when the whole was taken up. The ſolution looked clear, and depoſited nothing on ſtanding. Mild mineral alkali had no effect upon it; but mild vegetable alkali threw down a copious ſediment in white flocculi, which was rediſſolved by cauſtic alkali, lime-water, and partly by mild mineral alkali. Phlogiſticated alkali, acid of ſugar, and acid of tartar, had no effect upon it. The other portion of ſublimate, which had been mixed with diſtilled water, was very little diſſolved; but in pouring it into a matraſs ſome ſmall round lumps were obſervable on the bottom of the glaſs. Theſe were ſix or ſeven in number, ſome weighing a whole grain, others not more than one-half. They were very hard and compact, with a ſmooth ſurface, and in figure reſembling the nucleus of the original calculus. The whole was then put into a matraſs with about three ounces of water. On boiling it on ſand for three quarters of an hour, about one-half, of it was taken up: the ſolution paſſed the filter very clear whilſt hot; but on cooling became turbid, and at laſt depoſited white flocculi, which were rediſſolved on the addition of cauſtic volatile alkali and lime-water. It turned ſyrup of violets green; which, however, our author thinks might have been occaſioned by its retaining volatile alkali, though it had not the ſmalleſt appearance of any ſuch impregnation. He has nevertheleſs frequently obſerved, that ſometimes the pureſt vegetable alkali contains volatile alkali, notwithſtanding the various operations and degrees of heat it undergoes before it can be brought to the degree of purity at which it is called ſalt of tartar.

On filtering the ſolution to ſeparate what had been depoſited by cooling, no change was produced in the filtered liquor by mineral alkali; but mild vegetable alkali produced a cloudineſs, which was inſtantly taken up on adding mineral alkali and lime-water. Neither Pruſſian alkali, nor the acids of arſenic, tartar, ſugar, or borax, nor any of the three mineral acids, had any effect upon it.

1466 Experiments with nitrous acid.

2. An hundred and twenty grains of the ſame calculus were put into a tubulated glaſs retort, and half an ounce of ſtrong nitrous acid poured upon it. An efferveſcence immediately enſued; and ſome part of the extricated aerial fluid being perſerved, appeared to be fixed air mixed with a ſmall quantity of nitrous air. When the efferveſcence ceaſed, a quarter of an ounce more of nitrous acid was added. On digeſting the mixture upon hot ſand for an hour, it emitted nitrous vapour and nitrous air; but the latter in very ſmall proportion. When the ſolution was completed, the whole was poured into a ſmall matraſs, and gently boiled till the ſuperabundant nitrous acid was nearly expelled. The ſolution was of a deep yellow colour and turbid; but on adding five ounces more of water, and digeſting it for a quarter of an hour longer, it acquired the colour and conſiſtency of dephlogiſticated nitrous acid. On cooling it became ſomewhat turbid, and in a few days depoſited a darkiſh yellow powder; which, when ſeparated, waſhed, and dried, weighed little more than a quarter of a grain, and, on examination, was found to be a calx of iron.

1467 Cryſtallizes on expoſure to the ſun.

Our author being deſirous to know what effect the ſun would have upon it, placed it in a window where the ſun ſhone full upon it for four hours every day. Here a little moiſture ſeemed daily to exhale from it, the weather being hot, and the matraſs, which had a ſhort wide neck, being only covered, with bibulous paper to keep out the duſt. In this ſituation, in the courſe of a week, a few very ſmall cryſtals appeared to float upon the ſurface. Theſe in time fell to the bottom, where they adhered together ſo as to form a hard concretion, ſtill retaining a cryſtalline appearance, but ſo ſmall and confuſed, that it was impoſſible to diſtinguiſh their figure; and this depoſition of cryſtals continued for a month, after which it ſeemed to ceaſe. The ſolution was then filtered to ſeparate the ſalt; after which one-half of the liquor was evaporated away, and the reſt ſet in the uſual place for a fortnight longer, but no more cryſtals appeared. The ſalt, which weighed three grains, was then digeſted in four ounces of diſtilled water; but no part ſeemed to be diſſolved. Three ounces of the water were then decanted off, and ſix drops of vitriolic acid added to the remainder, which by the help of digeſtion ſeemed to diſſolve the ſalt ſlowly; but on adding half an ounce more diſtilled water, the whole was readily taken up. Acid of ſugar had no effect on this ſolution; but lime-water rendered it turbid. The whole was then precipitated with cauſtic volatile alkali, and the ſolution filtered, which likewiſe threw down the lime from lime-water. The precipitate was then waſhed, and diſtilled vinegar poured upon it, which did not take it up; but it was diſſolved by marine acid. Phlogiſticated alkali had no effect upon it; and the acid of ſugar occaſioned very little cloudineſs after ſtanding three or four hours; from which our author ſuppoſed that the matter was phoſphorated clay.

The ſolution, being now free from iron and phoſphorated clay, had a ſubacid taſte, and looked clearer, though ſtill retaining a yellow caſt. Acid of ſugar had no effect upon it; but nitrated terra ponderoſa threw down a precipitate, as did likewiſe the cauſtic volatile alkali. Mild vegetable alkali cauſed no precipitation; which our author attributed to the ſolution of the manganeſe and clay by the fixed air extricated from the alkali. Two-thirds of the ſolution were then put into a ſmall glaſs retort, and two ounces diſtilled off, which had no taſte, but ſmelled very agreeably, and not unlike roſe-water. After all the liquor had paſſed over, white fumes appeared in the retort, and theſe were ſoon followed by an aerial fluid. On collecting ſome of this, a candle was found to burn in it with an enlarged flame. Nitrous air did not diminiſh it in the leaſt; and it ſeemed to be that ſpecies of air into which nitrous ammoniac is convertible. No more than 13 or 14 inches of this kind of air could be obtained; and as ſoon as it ceaſed to come over, cryſtals were obſerved in the lower part of the neck of the retort. On augmenting the heat, a white ſalt began to ſublime and adhere to the upper part of the retort; the operation was continued until the retort was red-hot; but, on breaking it, the quantity of ſublimate was ſo ſmall, that very little of it could be collected; though, from the ſmall quantity obtained, our author was convinced of its being the ſame in quality with what was obtained in the former analyſis. The ſalt which cryſtallized in the neck of the retort was nitrous ammoniac, as appeared from its detonation *per ſe*, &c. A grey powder was left in the bottom of the retort, which hot diſtilled water partly diſſolved; muriated terra ponderoſa, acid of ſugar, and vegetable alkali, rendered this ſolution turbid: but cauſtic volatile alkali had no effect upon it. The remaining part of the powder which was left by the diſtilled water, readily diſſolved with efferveſcence in the marine acid, and was precipitated by cauſtic volatile alkali; the part ſoluble in diſtilled water appearing to be gypſum, and that ſoluble in marine acid to be magneſia.

From all theſe experiments, Mr Higgins concludes the compoſition of the human calculus to be vaſtly different

1468
Higgins's account of the conſtituent parts of calculus.

ferent from what either Mr Scheele or Mr Bergman have ſuppoſed it to be. "It appears (ſays he), that the calculus was compoſed of the following different compounds blended together; *viz.* ſelenite, alum, microcoſmic ſalt, mild volatile alkali, lime, and cauſtic volatile alkali, combined with oil, ſo as to form a ſaponaceous maſs; calx of iron, magneſia combined with aerial acid, clay enveloped by a ſaponaceous and oily matter, and the ſublimate already deſcribed." Conſidering this to be the true ſtate of the calculus in the bladder, the ſmall proportions of clay, ſelenite, magneſia, and iron, which are the moſt inſoluble of the ingredients; the great ſolubility of microcoſmic ſalt and alum, and the miſcibility of lime, volatile alkali, and oil, in water; tend to ſhow, that the ſublimate is the cementing ingredient. Indeed, its inſolubility in water, and property of forming nuclei out of the body, as above obſerved, leave no room to doubt it. The proportion of the other ingredients, and very likely their preſence, depend upon chance, volatile alkali and oil excepted; therefore this ſublimate ſhould be the object of our inveſtigation.

1469
Remarks on the remedies proper for diſſolving it.

Mr Higgins concludes his diſſertation with ſome practical remarks concerning the remedies proper for diſſolving the ſtone, for counteracting that diſpoſition in the body which tends to produce it, and concerning the regimen proper for thoſe who are to undergo the operation of cutting for it. "The effect of mild mineral alkali (ſays he) on the ſublimate, is well worth the attention of thoſe who may have an opportunity of trying its efficacy. Mild mineral alkali may be taken in large doſes, and continued for a length of time with impunity to the moſt delicate conſtitutions, only obſerving a few circumſtances; but this alkali, in a cauſtic ſtate, muſt very often be attended with miſchievous conſequences. Beſides, if we conſider that it muſt enter the maſs of blood before any part can reach the bladder, and the ſmall portion of the doſe taken ſecreted with the urine, and, laſtly, the action of cauſtic alkali upon animal ſubſtances; we ſhall be at a loſs to know on what principle cauſtic alkalies have been recommended in preference to mild. Soap itſelf might as well be recommended at once; for ſoon after cauſtic alkali is taken, it muſt be in a ſaponaceous ſtate. Fixed vegetable alkali ſhould be avoided, and the perference given to the other two alkalies. As it is evident that alkalies have no real action on the ſtone in the bladder, though their efficacy has been experienced in alleviating the diſeaſe when timely adminiſtered, their mode of action is only explicable in the following manner: They either prevent the generation of the ſublimate in the ſyſtem, or elſe keep it in ſolution in the maſs of fluids: and being in the utmoſt degree of diviſibility, its ultimate particles are capable of paſſing through the moſt minute emunctories; by which means it is carried off by other ſecretions as well as the urinary. Thus urine, not being ſaturated with this matter, acts as a ſolvent on the ſtone; and as the moſt ſoluble parts are firſt waſhed away, it falls through time into fragments of irregular ſurfaces, which by their friction irritate and inflame the bladder, as has been obſerved by ſeveral practitioners.

"Allowing that the ſublimate is the cementing ſubſtance in the calculus, and judging, from the effects of alkalies upon it, their *modus operandi* in the conſtitution, it remains now to inquire into the origin of the calculus. Mr Scheele has found this ſublimate in the urine of different perſons; and hence inferred, that it was a common ſecretion; but it ſtill remains to be aſcertained, whether there be a greater quantity of it procured from the urine of patients who labour under this diſorder than in thoſe who do not? If this ſhould not be the caſe, may not a deficiency of volatile alkali in the conſtitution be the cauſe of the concretions in the kidneys, bladder, &c.; or, which muſt have the ſame effect, too great a proportion of acid, which, uniting with the alkali, may take up that portion which would have kept the ſublimate in ſolution until conveyed out of the ſyſtem by the urinary and other ſecretions; and may not this be the phoſphoric acid? If this latter ſhould be the caſe, an increaſe of microcoſmic ſalt muſt be found in the urine; but if the former, a decreaſe of the volatile alkali, and no increaſe of the neutral ſalt. The ſmall quantity of phoſphoric acid found in the calculus proceeds from the ſolubility of microcoſmic ſalt. Do not volatile alkali and phoſphoric acid conſtitute a great part of the human frame? and is their not a proceſs continually carried on to generate theſe in the ſyſtem? and is not this proceſs liable to be retarded or checked by intemperance, &c. which may vary their quantities and proportions? and may not a due proportion of theſe be neceſſary to a vigorous and ſound conſtitution? If ſo, no wonder that an increaſe or deficiency in either or both of theſe ſhould be productive of ſeveral diſorders."

1470
Sublimate of calculus found in conſumptive and gouty people.

On this ſubject, however, our author has not had ſufficient leiſure to make the experiments neceſſary for its elucidation. Indeed, it ſeems not eaſy to do ſo; as, in his opinion, at leaſt 500 would be required for the purpoſe. "That the urinary ſublimate is preſent in tubercles found in the lungs of perſons who die of pulmonary conſumptions, and likewiſe in what are vulgarly called *chalk ſtones*, is what I have experienced: but in what proportion, or whether in quantities ſufficient to cauſe the concretion, is what I cannot ſay; for I have had but a few grains of each to examine. I have every reaſon to ſuſpect, that conſumptions and ſcorbutic complaints very frequently ariſe from a ſuperabundance of this ſublimate in the ſyſtem; and that it is chiefly the cauſe of the gout and rheumatiſm, and ſolely the cauſe of the ſtone in the bladder. I make no doubt but theſe diſorders generally proceed from obſtructions: and it is probable, that either a precipitation of this ſublimate in the ſyſtem, or elſe a deficiency of ſome other ſecretion, which would hold it in ſolution until conveyed out of the body, may be the chief cauſe of thoſe obſtructions; and likewiſe, that different degrees of precipitation may produce different ſymptoms and diſorders.

"That mineral or volatile alkali and bark have been uſeful in the above diſorders, has been affirmed by experienced phyſicians; and I know an inſtance myſelf of mineral alkali and nitrous ammoniac being ſerviceable in a pulmonary complaint of ſome ſtanding.

"With reſpect to the ſtone, when it acquires a certain magnitude, it is abſurd to attempt to diſſolve it in the bladder, it waſtes ſo very ſlowly; and during this time the patient muſt ſuffer vaſt pain, particularly when the ſtone acquires a rugged ſurface: therefore cutting for it at once is much preferable.

"**Mineral alkali taken in the beginning of the com**plaint, and before the ſtone accumulates, will no doubt check its progreſs, and may in time change that diſpoſition in the habit. Patients who are cut for the ſtone ſhould, I think, take mineral alkali for ſome time when the wound is healed, but not before, for fear of bringing on a mortification."

APPENDIX;

Containing ſuch DISCOVERIES as have appeared ſince the Compilation of the Article, and which could not be inſerted in their proper Places.

I. *VITRIOLIC ETHER.*

1471 Various methods of rectifying vitriolic ether.

M. PELLETIER formerly propoſed a method of rectifying this fluid by putting mangneſe into the veſſels; but as the vitriolated manganeſe might perhaps communicate ſome injurious quality, another method is propoſed by M. Tingry. After firſt drawing off the ether, he adds a diluted ſolution of volatile alkali, **and avoids as much as poſſible the diſſipation** of the vapours: the ether is then rediſtilled. It may afterwards in this way be waſhed more ſafely, and with leſs loſs. The little proportion of the ether **which is ſeparated in the water, may be again recover**ed, or the water may be again employed for the ſame purpoſe. M. Lunel propoſes calcined magneſia for this purpoſe, as its ſalt is not ſoluble; though perhaps pure terra ponderoſa might be better.

II. *NITROUS ACID.*

1472 Mr Higgins's obſervations.

ON this ſubject Mr Higgins has ſeveral curious and intereſting obſervations. "It is not an eaſy matter (ſays he), to aſcertain exactly the greateſt quantity of dephlogiſticated air, which a given quantity of nitrous acid may contain. I always found nitre to vary, not only in its product of phlogiſticated and dephlogiſticated air, but likewiſe in their proportion to one another. The pureſt nitre will yield, about the middle of the proceſs, dephlogiſticated air ſo pure as to contain only about $\frac{1}{13}$ of phlogiſticated air. In the beginning, and nearly about the latter end of the proceſs, air will be produced about twice better than common air. On mixing the different products of a quantity of pure nitre, it was found that, by expoſure to liver of ſulphur, $\frac{1}{2}$ part was left unabſorbed; and this was the utmoſt **purity in which I obtained dephlogiſticated air from nitre.**

1473 Account of its conſtituent parts by M. Lavoiſier.

"According to M. Lavoiſier, 100 grains of nitrous acid contain $79\frac{1}{2}$ of dephlogiſticated air, and $20\frac{1}{2}$ of **phlogiſticated air, which is not quite four to one. But** his experiments contradict this; for whatever mode he adopted to decompoſe nitrous acid, it appeared that the proportion of dephlogiſticated air was nearly as five to one of phlogiſticated air.

1474 By Mr Cavendiſh.

"**Mr Cavendiſh has proved, that nitrous acid may** be formed by taking the electric ſpark in a mixture of three parts of phlogiſticated air, and ſeven of dephlogiſticated air, which is but $\frac{1}{7}$ more of dephlogiſticated air than nitrous air contains; which may apparently **contradict M. Lavoiſier's, as well as my own, eſtimation** of the proportion of the conſtituent principles of nitrous acid, when in its perfect ſtate. The red nitrous **vapour contains three parts of nitrous air and one of dephlogiſticated air, or one of phlogiſticated and three** of dephlogiſticated air; but nitrous vapour may be formed with a leſs proportion of dephlogiſticated air; and which, though it may not be ſo condenſible as a more perfect nitrous vapour, yet will, when in contact with pure alkali, unite with it, and form nitre, as was the caſe in the experiment of Mr Cavendiſh. The common ſtraw-coloured nitrous acid contains more dephlogiſticated air than the red nitrous acid or vapour; the proportion appears to be about four to one; but the colourleſs contains about five of dephlogiſticated to one of phlogiſticated air.

1475 Method of obtaining colourleſs nitrous acid.

"Having once a charge of nitrous and vitriolic acid in a green glaſs retort, I put it in a ſand-pot to diſtil; but the pot being ſmall, the edge came too near **the retort, about a quarter of an inch or more above** the charge; which, before the proceſs commenced, **and when it acquired more than the heat of boiling** water, cracked it all round in that direction. Being **thus ſituated, I was obliged to withdraw the fire, and,** before the charge got cold, to ladle it into an earthen **pan. On introducing it into a freſh retort, I obtained** from it nitrous acid nearly as colourleſs as water. The vitriolic acid uſed in this proceſs not being very perfect, the goodneſs of the nitrous acid was attributed to the purity of the nitre from whence it was diſtilled; but in another proceſs, though the ſame nitre was uſed with much purer vitriolic acid, the produce was of an high ſtraw colour. On recollecting the abovementioned circumſtance, the vitriolic acid and nitre were next mingled in due proportion, and expoſed in an earthen pan ſet in ſand, to nearly the heat of boiling water, for half an hour or more, continually expoſing freſh ſurfaces to the air. When the charge was quite cold, I introduced it into a retort, and diſtilled as colourleſs nitrous acid as the former. As no nitrous air was emitted during digeſtion, it muſt have imbibed dephlogiſticated air from the atmoſphere."

1476 How to ſet charcoal on fire by means of nitrous acid.

Mr Prouſt found, that ſtrong nitrous acid will ſet fire to charcoal if it be rendered very dry. He likewiſe remarked, that charcoal expoſed to the air a few hours after calcination, was unfit for the experiment. Charcoal, he obſerves, attracts moiſture very forcibly. The firſt effect of the charcoal on the nitrous acid, he obſerves, is to withdraw a portion of its water from it; by which it is rendered highly concentrated, at the ſame time that the condenſation of the water heats the charcoal in a ſmall degree, but ſufficiently to volatilize a nitrous vapour; which, as ſoon as it reaches that portion of dry charcoal next the humid part, is condenſed by it, and generates heat enough to promote the decompoſition of the nitrous acid. Hence we ſee why the experiment will not ſucceed if the acid be poured on the ſurface of the charcoal.

1477 Effect of nitrous acid on blood.

The effect of nitrous acid on blood, according to Mr Higgins, is very ſingular. Two parts of blood procured freſh at the butchers, one of ſtrong nitrous acid, and about one fifth of the whole of water, were digeſted in the heat nearly of boiling water (freſh portions of water being occaſionally added until the whole of the acid was expelled), when it acquired almoſt the colour, and exactly the taſte, of bile. When mixed with a large quantity of water, it acquired a fine yellow colour; and, on ſtanding, depoſited a ſubſtance of a brighter yellow, though the ſupernatant liquor ſtill retained a yellow colour and bitter taſte, but not ſo intenſely as when the precipitate was ſuſpended in it. The different ſtages of this proceſs were well worthy of obſervation. No nitrous air was produced, and the acid was expelled in the ſtate of a white vapour. The liquor was found to increaſe in bitterneſs as the acidity vaniſhed. About the middle of the proceſs, the ſolution firſt taſted acid, but was quickly ſucceeded by a bitter ſenſation. It appears that the nitrous acid took dephlogiſticated air from the blood; for though red nitrous acid was uſed, it was expelled in a perfect ſtate.

III. *Nitre.*

Though the artificial generation of the nitrous acid, from a mixture of dephlogiſticated and phlogiſticated air, is now ſufficiently underſtood, yet we do not well know in what manner nature performs the operation. Some chemiſts, particularly M. Thouvenal, have found, that putrefaction favours the production of nitrous acid. All animal ſubſtances, during their decay, give out a vaſt quantity of phlogiſticated air; therefore, if dephlogiſticated air be preſent, it will unite to the phlogiſticated air in its naſcent ſtate, and form nitrous acid: but Mr Higgins has obſerved, that nitrous acid may be generated in plenty where there is no putrid proceſs going on.

1478 Nitre generated without putrefaction.

"The chemical elaboratory at Oxford (ſays he) is near ſix feet lower than the ſurface of the earth. The walls are conſtructed with common limeſtone, and arched over with the ſame; the floor is alſo paved with ſtone. It is a large room, and very lofty. There are ſeparate rooms for the chemical preparations, ſo that nothing is kept in the elaboratory but the neceſſary implements for conducting experiments. There is an area adjoining it on a level with the floor, which, though not very large, is ſufficient to admit a free circulation of air. The aſhes and ſweepings of the elaboratory are depoſited in it. There is a good ſink in the centre of this area, ſo that no ſtagnated water can lodge there. Notwithſtanding all this, the walls of the room afford freſh crops of nitre every three or four months. Dr Wall, who paid particular attention to this circumſtance, and who told me it contained fixed vegetable alkali, requeſted I would analyſe it, and let him know what it contained. I found that two ounces of it contained ſix drachms of nitrated fixed vegetable alkali, and three of calcareous nitre. The nitre firſt appears in ſmall whitiſh filaments as fine as cob-web, which, when they get a little larger, drop off; ſo that they never acquire ſufficient growth to diſtinguiſh their figure to a naked eye. On finding that they contained fixed vegetable alkali, I concluded that it proceeded from minute vegetation; but in this I was miſtaken; for I found that they were ſoluble in water, and that they detonated with charcoal at every ſtage of their growth. Having ſwept this ſaline effloreſcence from the wall, I dug deep into it, but could not obtain nitre from it. When a part had been white-waſhed, it yielded nitre, but not ſo abundantly as a neighbouring ſpot which had not been treated in the ſame manner. Hence it is evident, that nitrous acid may be formed without the aſſiſtance of putreſcent proceſſes in a ſtill damp air, where there is a ſubſtance to attract it when half formed, whereby it is in time brought to perfection. The above facts moreover prove, that fixed vegetable alkali is a compound."

IV. *Marine Acid.*

1479 Unſucceſsful attempts to decompoſe ſea-ſalt

Mr Higgins informs us, that he has, with a view to decompoſe ſea-ſalt, mixed it with mangane ſe in various proportions, and expoſed them in a reverberating furnace in a well cloſed crucible for three hours, to a heat nearly ſufficient to melt caſt iron. In the ſame manner he treated mangane ſe, ſalt, and charcoal, as well as clay, ſalt, and charcoal, and ſalt and clay alone, with very little ſucceſs. He treated calcined bones, ſalt, and charcoal, and calcined bones and ſalt, as well as lime and ſalt, in the ſame manner, without effecting any apparent change in the ſalt. He was informed, however, by Mr Robertſon, apothecary in Biſhopſgate-ſtreet, that he had partially alkalized it, by expoſing it with clay to a fierce heat; but that ſoon after it got into contact with air, it became neutral again. "If common ſalt and litharge be fuſed (ſays Mr Higgins), it is in part decompoſed; the acid ſuffers no decompoſition, but unites with the lead; whereby it acquires, when the ſaline matter is waſhed away, a yellow colour. It is evident (adds he) from theſe facts, that the baſis of marine acid is a combuſtible body, and quite different from light inflammable air, charcoal, or any known inflammable ſubſtance; and that it attracts dephlogiſticated air with greater force than any ſubſtance hitherto diſcovered. Though charcoal will decompoſe all other acids, except a few, when united to bodies which will fix them until they acquire a ſufficient degree of heat, yet it has no effect upon marine acid."

According to Fourcroy, if alkaline air be confined by mercury, and dephlogiſticated marine acid air be added to it (which muſt be done quickly, as the acid air would diſſolve the mercury), each bubble produces a ſlight detonation, and furniſhes a very amuſing ſpectacle.

1480 Method of diſtilling ſpirit of ſalt with clay.

Though in Britain the diſtillation of the ſpirit of ſalt with clay has long been entirely laid aſide for the proceſs with oil of vitriol, yet it is ſtill practiſed in other countries, and may be effected in the following manner: Having previouſly decrepitated the ſalt, and dried the clay, they are then to be ground, mixed, and ſifted together. The mixture is next to be worked with a ſpatula, and then with the hands, until it is brought into a moderately ſtiff and uniform maſs.

This is to be divided into balls about the ſize of a pigeon's egg, ſo that they can paſs through the neck of the retort; but before they are put into the diſtilling veſſel, it is proper to dry them thoroughly. The retorts muſt be of ſtone-ware, and carefully coated, in order to prevent them from breaking with the intenſe heat to which they are expoſed. They are to be filled two-thirds full of materials, and the diſtillation muſt be performed in a reverberatory furnace. The receiver at firſt is not luted on, becauſe that which riſes in the beginning of the diſtillation, being very aqueous, is to be put by itſelf. When this has come over, another receiver is then to be applied, and cemented with fat lute, and covered with a cloth daubed with a mixture of lime and the whites of eggs. The heat is to be raiſed until the retort is red-hot, and continued in this degree until the diſtillation ceaſes.

Various proportions of clay and ſalt have been recommended for this proceſs; but it ſeems probable that not leſs than ten parts of clay to one of ſalt, as Pott has directed, will be found neceſſary. Inſtead of the clay, ſome direct the uſe of bole; but this is inconvenient on account of the iron it contains. Powdered talc has alſo been recommended, but this is not always free from iron; and where a very pure ſpirit is wanted, there is a neceſſity for having recourſe to oil of vitriol, and glaſs or ſtone-ware veſſels. As the marine acid cannot be ſeparated from the earthy mixtures abovementioned, but by means of moiſture, M. Beaumé adviſes to moiſten the reſiduum, and repeat the diſtillation, by which more acid will be obtained.

1481 Effect of marine acid upon phlogiſtic matters.

As the marine acid has very little action upon phlogiſtic matters, it cannot therefore affect oils, either expreſſed or eſſential, in a manner ſimilar to the vitriolic or nitrous. M. Marges, however, has obſerved yellow cryſtals reſembling amber formed in bottles, containing a mixture of oils and marine acid of moderate ſtrength, which had ſtood for ſeveral months. The little effect which the marine acid has upon theſe ſubſtances was firſt ſuppoſed to be owing to its want of phlogiſton in itſelf; but when it was afterwards found, that, by the application of certain ſubſtances which have a great attraction for phlogiſton, the marine acid was rendered capable of uniting very readily with inflammable matters, the former theory was abandoned. It was now aſſerted, that the acid, inſtead of containing no phlogiſton, was naturally endowed with a very conſiderable quantity; and that, in its new ſtate, it was dephlogiſticated by the ſubſtances applied. On the other hand, the antiphlogiſtians aſſerted, that no change was thus made upon it, farther than adding a quantity of pure air, which they ſuppoſe to be the baſis of all acids. On this ſubject, however, M. Cornette maintains, that the marine acid ſeems to have ſo little action upon inflammable ſubſtances, merely becauſe it is weaker than the reſt; and likewiſe that it is often previouſly combined with ſome inflammable matter, by which its attraction is prevented. He maintains, that if the marine acid be concentrated in ſuch a manner as to render its ſpecific gravity to that of water as 19 to 16, it will then act upon oils with heat and efferveſcence, reducing them to a black and thick ſubſtance, and even burning them to a kind of coal. Some experiments have been made by Mr Haſſe, with a view to inveſtigate the action of the marine and vitriolic acids upon balſams and oils; for which purpoſe he mixed two drachms of ſmoking ſpirit of ſalt with one of each of the oily ſubſtances to be tried. The reſults were, that Canada balſam gained one ſcruple in weight; balſam of capivi 19 grains; ſtorax, and Venice turpentine, each one ſcruple; aſphaltum 18 grains; but the eſſential oils of aniſe-ſeed, benzoin, bergamot, coriander, and many others, were not altered in any degree. The action of this acid upon inflammable matters, however, is augmented by its being reduced into the form of air.

Gmelin relates, that, by diſtilling a mixture of five parts of ſalt, twelve of ſpirit of wine, and four of vitriolic acid, to which he had previouſly added one or two parts of water, he obtained a completely dulcified ſpirit of ſalt, and an imperfectly dulcified ſpirit of vitriol, upon rectifying the liquor.

1482 Glaſs corroded by it.

Homberg found, that glaſs was corroded by the marine acid: and his obſervation has been confirmed by Dr Prieſtley; who finds that its corroſive power is augmented by confining the acid in tubes hermetically ſealed. Its power is exerted not only on flint-glaſs, but even on common green glaſs; though more powerfully on the former, where it chiefly attacks the red-lead uſed in its compoſition. By incloſing marine acid gas for ſome weeks in a glaſs tube expoſed to heat, an incruſtation was formed on the inſide, while the air was diminiſhed to $\frac{1}{3}$ of its original bulk, one half of which was abſorbed by water; the other was phlogiſticated air.

1483 Cauſe of the yellow colour of marine acid.

The marine acid is generally met with of a yellow or reddiſh colour, which by Macquer is given as one of its characteriſtic marks. In general, however, this colour is thought to proceed from iron; but Dr Prieſtley has found that it may be produced by many different ſubſtances; and his obſervations have been confirmed by Scheele and other chemiſts. The Doctor is of opinion that it is occaſioned for the moſt part, if not always, by a mixture of earth; and he was able to communicate it by means of calcined oyſter-ſhells, calcined magneſia, pipe-clay, or pounded glaſs; but not by wood-aſhes, from whence the air had been expelled by heat. It was effectually diſcharged by flowers of zinc, a coal of cream of tartar, and by liver of ſulphur; but he found that the colour which had been diſcharged by liver of ſulphur, would return by mere expoſure of the acid to the atmoſphere, but not that which had been diſcharged by flowers of zinc.

Dephlogiſticated ſpirit of ſalt.

1484 Expeditious method of bleaching linen.

When the action of this vapour upon any thing is to be examined, the ſubſtance muſt be put into a bottle in ſuch a manner as to remain in contact with it; or it may be put into a glaſs tube, which is ſuſpended and fixed to the ſtopper, and thus introduced into the bottle.—From its property of deſtroying all vegetable colours, it promiſes to be of very conſiderable uſe in the arts, provided it could be had in ſufficient quantity, and cheap. It bleaches yellow wax, and when properly applied to linen, will whiten it ſufficiently, and without injury in a few hours. This may be effected by ſteeping the linen for that ſpace of time in water impregnated with the dephlogiſticated marine gas. It unites with this fluid rather more eaſily than fixed air.

Berthollet, in order to impregnate water with it without expoſing the operator to the fume, which is extremely diſagreeable, put the mixture of marine acid and manganeſe into a retort. To this he applied firſt an empty bottle, and then ſeveral others filled with water, and communicating with each other by means of bent tubes, ſurrounding the whole with ice. When the water in the bottles was ſaturated, the gas became concrete, and fell to the bottom; but with the ſmalleſt heat it aroſe to the top in bubbles. The ſpecific gravity of the ſaturated water was to that of diſtilled water, when the thermometer was only five degrees above the freezing point, as 1003 to 1000. This impregnated water is not acid, but has an auſtere taſte, and has the ſame action as the gas, though in a weaker degree. Mr Berthollet has obſerved, that the addition of alkalies does not prevent, but rather promotes, the diſcharge of colours; for which reaſon he directs to add a fixed alkali to the impregnated water in which linen is to be ſteeped for bleaching. This is the expeditious method hinted at under the article BLEACHING; but which has not hitherto come into uſe, principally through the high price of the dephlogiſticated gas.

The dephlogiſticated marine acid does not diſcharge all colours with equal eaſe. Thoſe of litmus and ſyrup of violets are entirely deſtroyed, and turned white. The colouring matter of Brazil-wood, and ſome green parts of plants, retain a yellow tint. The leaves of evergreen plants reſiſt its action for a long time, and at laſt only acquire the yellow colour which they aſſume by long expoſure to the air; and in general the changes of colour which vegetable matters ſuffer from this gas, are ſimilar to thoſe which take place on long expoſure to the air; and by this operation the gas is converted into common marine acid.

1485 Effect of the dephlogiſticated acid on phlogiſtic matter, &c.

Oils and animal fats are thickened by this gas; and by theſe and other inflammable ſubſtances it is reduced to the ſtate of common marine acid. Light is ſaid to produce the ſame effect. It unites with fixed alkalies and calcareous earths, but without any ſenſible effervеſcence; and thus they loſe their peculiar taſte and colour. M. Berthollet having boiled in a retort, to which a pneumatic apparatus was affixed, ſome of the dephlogiſticated marine acid liquor with mineral alkali, thus obtained a conſiderable quantity of elaſtic fluid, compoſed partly of fixed air, partly of the air contained in the veſſels, and partly of air conſiderably purer than that of the atmoſphere. The reſult of the combination was common ſalt. On repeating the experiment with lime, no fixed air was obtained; but that which came over became gradually more and more dephlogiſticated. Volatile alkali, even when cauſtic, occaſioned an efferveſcence, and emitted a peculiar kind of air, which was neither fixed nor dephlogiſticated, but of a peculiar kind.

Green vitriol is changed to a red by the dephlogiſticated gas, but the colour of blue and white vitriol is not affected. By the aſſiſtance of light, it acts upon phoſphorus, and the reſult is phoſphoric and common marine acids. It does not diſſolve ice nor camphor; in which reſpects it differs from the common marine acid gas.

1486 Marine ether.

On mixing marine acid, manganeſe, and ſpirit of wine, and diſtilling them with a very gentle heat, little air of any kind is produced, but a quantity of ethereal liquor very ſlightly acid. The proportion uſed by Pelletier were an ounce and a half of manganeſe, five ounces of concentrated marine acid, and three ounces of ſpirit of wine. "In this proceſs (ſays Mr Kier), the whole of the dephlogiſticated acid ſeems to have united with the ſpirit of wine, and to have formed ether. The difficulty of combining marine acid with ſpirit of wine, ſo as to form an ether, is well known, and though there have been ſome approximations to it, yet the only inſtances in which it has been completely effected, have ſucceeded in conſequence of the marine acid being dephlogiſticated; by which its action on ſpirit of wine, as well as on all inflammable matters, is greatly increaſed."

M. Pelletier has obſerved, that when we put a bit of phoſphorus into dephlogiſticated marine gas, the former is immediately diſſolved, and a light is perceived, the veſſel being filled at the ſame time with white vapours.

1487 Method of procuring a detonating ſalt from the acid in quantity.

He has likewiſe obſerved, that ſea-ſalt, with an exceſs of pure air, thrown into heated vitriolic acid produces a ſmall detonation. To make this ſalt in quantity, take, for inſtance, ten pounds of ſea-ſalt, mixing it with from three to four pounds of manganeſe, pour on the mixture ten pounds of vitriolic acid, and diſtil with Woulfe's apparatus. Paſs the diſengaged acid through a ſolution of fixed vegetable alkali, either cauſtic or otherwiſe. A little more than ten ounces of the new marine ſalt with exceſs of pure air is obtained, and a quantity of ſalt of Sylvius, or digeſtive ſalt. The ſalt with exceſs of pure air cryſtallizes firſt, and by means of repeated cryſtallizations, is entirely diſengaged from the other.

V. *AQUA REGIA.*

1488 Various ways of preparing aqua-regia,

THIS acid, which is named from its property of diſſolving gold, is compounded of the nitrous and marine acids. Gold and platina cannot be diſſolved in any other menſtruum, nor can regulus of antimony and tin be ſo eaſily diſſolved by any other as aqua-regia. It may be made various ways. 1. By adding the two acids to each other directly. 2. By diſſolving in the nitrous acid ſome ſalt containing marine acid, particularly ſal ammoniac and common ſalt. 3. By diſtilling nitrous acid from either of theſe ſalts. And, 4. In Dr Prieſtley's method of impregnating marine acid with nitrous acid vapour.

1489 Differences between theſe acid liquors.

The only difference between thoſe liquors prepared by the methods abovementioned is, that when ſal ammoniac or ſea-ſalt are diſſolved in the nitrous acid, the aqua-regia contains a quantity of cubic nitre, or nitrous ammoniac, which, tho' it cannot much affect the acid as a ſolvent, may make a conſiderable difference in the nature of the precipitate. Thus, gold precipitated from an aqua-regia formed by the pure nitrous and marine acids, does not fulminate, though it does ſo when precipitated from one made with ſal ammoniac. There are no eſtabliſhed rules with regard to the proportions of nitrous and marine acids, or of nitrous acid and ſal ammoniac, which ought to be employed for the preparation of aqua-regia. The common aqua-regia is made by diſſolving four ounces of ſal ammoniac in 16 ounces of nitrous acid; but theſe proportions muſt be varied, according to the nature of the intended ſolution.

Borax.

tion. Platina, for inſtance, is diſſolved in the greateſt quantity by equal parts of the two acids; regulus of antimony by four parts of nitrous acid to one of marine; and, in general, the greater the quantity of marine acid employed in the mixture, the leſs are the imperfect metals, particularly tin, calcined or precipitated by it. A mixture of two parts of ſpirit of nitre, and one of ſpirit of ſalt, diſſolves nearly an equal weight of tin into a clear liquor, without forming any precipitate; but, for this purpoſe, the operation muſt be conducted ſlowly, and heat avoided as much as poſſible.

VI. *BORAX.*

1490 Methods of purifying borax.

IN a memoir in Crell's Chemical Annals, by M. Tychſon, the author ſhews, by different experiments, that it may ſometimes be purified by ſolution, filtration, and evaporation only; but that ſometimes the operation is more eaſy and effectual by previous calcination; but then the product is a little leſſened, eſpecially if the calcined maſs be not well powdered, and then boiled ſufficiently in water. Powder of charcoal, he ſays, may be ſometimes advantageouſly employed in the purification; but in general there is no difference between the crude and purified borax, except in the addition of extraneous matters; at leaſt, as the quantity of acids is the ſame, the addition of mineral alkali is uſeleſs: theſe extraneous matters are an animal fat, and a ſand compoſed of clay, lime, and a martial earth. If the oily matter of tartar be ſeparated by paſſing the lixivium through a ſtratum of clay, as is ſuppoſed in the preparation of the cryſtals at Montpelier, it would ſuggeſt a method of greatly abridging the proceſs of the purification of borax.

VII. *ACID of BORAX, or SEDATIVE SALT.*

1491 Methods of preparing the ſedative ſalt from borax.

ON the preparation of this ſalt Mr Beaumé obſerves, that a little more acid ought to be added to the borax than what is juſt ſufficient to ſaturate its alkaline baſis. Unleſs this be done, the ſedative ſalt remains confounded with the other ſaline matters in the ſolution, and in conſequence the cryſtallization muſt be diſturbed. The ſalt, though formed in an acidulated liquor, is eaſily deprived of its ſuperfluous acid by draining upon paper. It does not cryſtallize as ſoon as the ſtronger acid ſeparates it from its baſis, even tho' the ſolution of borax had been previouſly made as ſtrong as poſſible; but this delay is occaſioned by the heat of the liquor; for as ſoon as it cools, a conſiderable quantity of cryſtals is formed.

1492 Its properties.

The acid of borax does not fall into powder when expoſed to the air, but rather attracts a little moiſture from it. Its taſte is at firſt ſomewhat ſouriſh, then cooling and bitteriſh; and laſtly, it leaves an agreeable ſweetneſs on the tongue. It makes a creaking ſound, and feels a little rough between the teeth; and when vitriolic acid is poured upon it, exhales a tranſient odour of muſk. It is ſoluble, according to ſome chemiſts, in the proportion of one to 20 in cold water, or of one to eight in boiling water. Wenzel informs us, that 960 grains of boiling water diſſolve 434 of the ſalt; while, on the other hand, Morveau aſſerts, that he could diſſolve no more than 183 grains in a pound of diſtilled water. Rouſs informs us, that fixed air prevents the ſolution of the ſalt in water; and Morveau, that its ſolubility is much augmented by cream of tartar. When previouſly made red hot, it diſſolves in water with a ſmell of ſaffron, and a grey powder of an earthy appearance is precipitated, which is ſoluble in vitriolic and marine acids, and may be again precipitated in the form of ſedative ſalt.

Acid of borax and its combinations.

Phlogiſticated alkali makes no change on ſedative ſalt in ſolution; but paper dipped in a ſolution of it in vinegar, and afterwards dried, burns with a green flame. It is capable of vitrification, though mixed with fine powder of charcoal; and with ſoot unites into a black maſs like bitumen; which, however, is eaſily ſoluble in water, and can ſcarce be reduced to aſhes, but partly ſublimes. By the aſſiſtance of heat it diſſolves in oils, eſpecially thoſe of the mineral kind; and with theſe it yields ſolid and fluid compounds, which gives a green colour to ſpirit of wine. Rubbed with phoſphorus it does not prevent its inflammation; but a yellow earthy matter is left behind. It ſeems alſo to give to white and red arſenic a great degree of fixity, ſo as even to become vitreſcible in the fire; and this property it communicates alſo to cinnabar. When mixed and heated with powder of charcoal, it forms no liver of ſulphur.

Sedative Salt COMBINED,

1. *With volatile alkali.* The produce of this is a peculiar ammoniacal ſalt, which does not evaporate when thrown on burning coals, or otherwiſe intenſely heated, but melts into glaſs of a greyiſh colour, but tranſparent, which cracks when expoſed to the air; and, on diſſolution in water, ſhoots into ſmall cryſtals, which appear to have loſt none of their alkaline baſis. It may be decompoſed by the acetous as well as the mineral acids, and by fixed alkalies and lime.

2. *With magneſia* this acid ſhoots into irregular cryſtalline grains ſoluble in vinegar and acid of ants; in which liquids they cryſtallize like ſmall needles joined together at right angles. They are decompoſed by all other acids, and likewiſe by ſpirit of wine. In the fire, however, they melt eaſily without any decompoſition; and in the dry way ſedative ſalt decompoſes all the earthy ſalts formed by magneſia and any of the volatile acids.

3. *With pure earth of alum,* ſedative ſalt forms a ſalt very difficult of ſolution, when one part of earth is ground with four times its weight of ſedative ſalt and water. The ſame kind of earth, mixed with half its weight of ſedative ſalt, forms a hard grey maſs, reſembling pumice ſtone; part of which is ſoluble in water, and yields a mealy ſediment, together with ſome ſedative ſalt unchanged.

4. *With ſiliceous earth* the ſedative ſalt does not unite in the moiſt way; but, on melting one part of acid with two of this earth, we obtain a frothy, hard, greyiſh-white maſs, from which, however, the acid may be again procured.

5. *Gold* is not acted upon in the wet way by acid of borax; nevertheleſs Routs obſerved, that when ſedative ſalt was melted with gold leaf, it did not vitrify, but became frothy and hard [illegible] not colour the flame of ſpirit of wine, and only a little of it was ſoluble in water in which ſedative ſalt had been cryſtallized.

A

Acid of borax and its combinations.

A ſolution of borax in which ſedative ſalt was diſſolved, did not precipitate gold.

6. *Platina* is not precipitated from aqua-regia by ſedative ſalt.

7. *Silver* is not affected by melting with an equal quantity of ſedative ſalt; but the latter is vitrified in ſuch a manner as to become inſoluble in water.

8. *Mercury* is not diſſolved either in the dry or wet way; but a ſolution of borax ſaturated with ſedative ſalt precipitates it in a yellow powder from nitrous acid.

9. *With copper.* On this metal ſedative ſalt acts but weakly, even when the ſolution is boiling hot; nevertheleſs, as much of the metal is diſſolved, as gives a little white precipitate on the addition of fixed alkali; but volatile alkali does not throw down a blue precipitate, nor turn the ſolution of that colour. The ſolution of borax precipitates all ſolutions of copper in acids, and then the ſedative ſalt unites with the copper in form of a light green jelly, which, after drying, is of very difficult ſolution in water. Bergman ſays, it is of an agreeable green colour, which it preſerves after being dried; and that, when expoſed to the fire, it melts into a dark-red vitreous ſubſtance. Wenzel aſſerts, that by long continued trituration of copper filings with ſedative ſalt he obtained a ſolution of the metal, which yielded cryſtals on being evaporated. With twice its weight of copper in a covered crucible, an inſoluble vitreous maſs was obtained.

10. *Tin* is not apparently acted upon by boiling with ſedative ſalt; nevertheleſs, the ſolution becomes turbid on the addition of an alkali. By melting the calx with half its weight of ſedative ſalt, we obtain a black maſs like the dark coloured tin ore. By rubbing for a long time filings of tin with ſedative ſalt and water, and afterwards digeſting the mixture with heat for one day, an hard, ſandy, and irregularly ſhaped ſalt was obtained, which, by diſſolution in water, yielded tranſparent, white, polygonous cryſtals; and a ſalt of of the ſame kind was obtained from the ſlag produced by melting equal parts of ſedative ſalt and tin filings.

11. *Lead* is not acted upon directly; but, on adding a ſolution of borax to ſolutions of the metal in vitriolic, nitrous, marine, or acetous acids, the ſedative ſalt unites with the lead. One part of ſedative ſalt with two of minium gives a fine, greeniſh-yellow, tranſparent, and inſoluble glaſs.

12. *With iron.* The acid of borax diſſolves this metal more eaſily than any other. The ſolution is amber-coloured, and yields an ochry ſediment, with cluſters of yellow cryſtals containing a little iron. The metal is precipitated by borax from its ſolutions in vitriolic nitrous, marine, and acetous acids, and the precipitates are ſoluble in ſedative ſalt. A ſolution of iron may alſo be obtained by melting this ſalt with iron filings, and lixiviating the maſs.

13. *Zinc* communicates a milky colour by digeſtion with ſolution of ſedative ſalt. By evaporation it affords a confuſed ſaline maſs, and a white earthy powder by precipitation with alkali. Flowers of zinc, melted with ſedative ſalt, form a light green inſoluble ſlag.

14. *Biſmuth*, in its metallic ſtate, is not acted upon by ſedative ſalt, but is precipitated by borax from a mixture of vitriolic and marine acids, in form of a very white powder, which keeps its colour when expoſed to air, and melts in the fire to a white, tranſparent, and permanent glaſs.

Acid of borax and its combinations.

15. *Regulus of antimony* is not acted upon directly, but its calx is diſſolved when precipitated by borax from a ſolution in aqua-regia.

16. *White arſenic* unites with ſedative ſalt either in the dry or moiſt way, and forms a cryſtallizable compound, forming either pointed ramifications, or white, greyiſh, and yellowiſh ſaline powder.

17. *On regulus of cobalt* the acid has no direct action; but borax precipitates it from its ſolution, and the calx melts with the ſalt into a ſlag of a bluiſh-grey colour; and this, by lixiviation and evaporation, affords a ſedative ſalt impregnated with cobalt, of a reddiſh white colour, and of a ramified form.

18. *Nickel* is precipitated from its ſolution, and the ſedative ſalt unites with it into a ſaline ſubſtance difficult of ſolution.

1495
Experiments made to determine the nature of the ſedative ſalt.

A variety of opinions have been formed concerning the nature of ſedative ſalt. M. Beaumé and M. Cadet particularly have made a great number of experiments on the ſubject, but as none of theſe have led to any certain concluſion, we forbear to mention them at preſent. Thoſe of Meſſrs Exſchaquet and Struve have indeed eſtabliſhed ſome kind of relation between the acids of borax and phoſphorus, and they have made ſeveral attempts to analize the former, but with little ſucceſs. The moſt remarkable of theſe experiments are the following. 1. They diſtilled, with a ſtrong heat, two parts of phoſphoric acid evaporated to the conſiſtence of honey, one of ſedative ſalt, and two of water. Towards the end of the diſtillation a very acid liquor was obtained; and the reſiduum was a white earth, in quantity above three-fourths of the ſedative ſalt employed, and which, on examination, was found to be the ſiliceous earth; the liquor which paſſed over into the receiver being found to be the volatile phoſphoric acid. If, in this experiment, too much phoſphoric acid be added, a greaſy matter remains; and, if too little, a part of the ſedative ſalt will remain undecompoſed. In their attempts to compoſe borax, they combined phoſphoric acid with mineral alkali, the reſult of which was a compound reſembling borax in many reſpects. When expoſed to the fire it melts into a very fuſible glaſs, which has a mild taſte, and ſeems neutral, but on expoſure to the air, becomes moiſt and acid. On being ſaturated with alkali a ſecond time and vitrified, it again deliqueſces and becomes acid; and the more frequently this operation is repeated, the greater is the reſemblance it bears to borax. In this experiment they ſuppoſed that the alkali was decompoſed, and converted into an earth ſimilar to that of ſedative ſalt.

With earthy ſubſtances the reſults were very remarkable. With earth of alum a cryſtallizable ſalt was obtained, which made paper burn with a green flame. Fixed alkali added to a ſolution of this ſalt precipitates an earth, and the ſalt then formed by cryſtallization reſembles borax in ſeveral properties.—In the dry way the earth of alum, with the phoſphoric acid, melts into a glaſs of the ſame fuſibility as that of borax, and like it is fixed in the fire. The ſolution of this glaſs did not cryſtallize. Common clay digeſted with phoſphoric acid produces ſilky cryſtals reſembling ſedative ſalt. When dried with their mother-water, theſe give a clear glaſs, which when united with mineral alkali, has the taſte of borax, ſmells in the ſame manner, and has the ſame effect upon metals. With lime, magneſia, and terra ponderoſa, this acid produces fuſible glaſſes, inſoluble in water, and which communicate a green colour to flame. Earth of bones and ſelenite mixed with the acid give a white, hard, ſhining glaſs, like the beſt cryſtal, but fuſible as the glaſs of borax, and which continued flexible after it had ceaſed to be red-hot. Two parts of gypſum, with one of phoſphoric acid, gave a milk white glaſs fit for ſoldering metals and enameling. In theſe experiments, however, it muſt be remembered, that unleſs the heat be raiſed very quickly, the phoſphoric acid will be evaporated before any fuſion takes place.

VIII. *Acid of Amber.*

It was known to Agricola, that a particular kind of ſalt could be obtained from amber by diſtillation; but neither he, nor any ſucceeding chemiſt for ſome time aſcertained its acid properties. On the contrary, ſome erred ſo far as to imagine that it was a volatile alkali; but, about the beginning of the preſent century, its acidity began to be generally acknowledged. This property indeed diſcovers itſelf by the taſte, which is manifeſtly acid and empyreumatic, along with the peculiar flavour of amber. According to Scheele, alſo, the aqueous fluid which paſſes over in the diſtillation of amber, is an acid reſembling vinegar both in taſte and chemical properties; and which of conſequence ought not to be confounded with the true acid of amber, which manifeſts qualities of a very different kind.

1494 Methods of purifying the ſalt of amber.

The properties of ſalt of amber can hardly be inveſtigated until it has been purified; for which, of conſequence, various methods have been propoſed. Pott recommends cryſtallization, after having filtered the ſolution through cotton-wool, in order to retain the oil. Cartheuſer attempts the purification by diſſolving the impure ſalt in ſpirit of wine, then diluting with ſix times its quantity of water, and cryſtallizing the ſalt. Others recommend ſublimation with common ſalt or ſand, and Bergman with pure clay.

The ſalt of amber diſſolves, by the aſſiſtance of heat, in nitrous and marine acids, and in the vitriolic without heat. In none of theſe combinations, however, does it either alter the diſſolving acids, or ſuffer any alteration itſelf, except that it becomes whiter; with nitre it detonates and flies off; and if the quantity of ſalt of amber has been greater than that of nitre, the latter is alkalized. Stockar informs us, that it expels the marine acid from ſal ammoniac, and ſublimes before that ſalt; with which it does not form any union. When ſublimed from common ſalt, it does not alter the latter in any other reſpect than giving it a darker colour. It precipitates calcareous earth from its ſolution in vinegar; and it decompoſes ſugar of lead; but the precipitate differs from plumbum corneum. It does not prevent the ſolution of lead in the acids of ſea-ſalt and nitre; nor does it produce any ſulphureous ſmell by calcination with charcoal. Hence it appears that it is neither a vitriolic, nitrous, nor marine acid; and M. Bourdelin muſt have been miſtaken, when he affirms, that, after detonation of this ſalt with nitre, he obtained a reſiduum, which taſted like common ſalt, decrepitated in the fire, yielded cryſtals of a cubical form, precipitated ſilver and mercury from the nitrous acid; and thence concluded that it was the ſame with acid of ſea-ſalt. It is very dear, as only about half an ounce can be obtained from a pound of amber.

Acid of Amber combined,

1. *With fixed vegetable alkali.* By ſaturating ſalt of amber with the fixed vegetable alkali, and then ſlowly evaporating the ſolution, we obtain, according to Wenzel, a light deliqueſcent ſaline maſs; but, according to Stockar, whoſe experiments are confirmed by thoſe of Mr Keir, the ſolution abovementioned affords ſhining white tranſparent cryſtals of a triangular priſmatic figure, with the terminating points truncated. Theſe cryſtals readily diſſolve in water, deliqueſce in the air, and have a peculiarly bitter ſaline taſte. In the fire they decrepitate, melt, and remain neutral; though Wenzel has obſerved, that with an intenſe heat they are decompoſed and become alkaline. Theſe cryſtals do not change aquafortis into aqua-regia; and though they precipitate both the ſolutions of lead and ſilver, the precipitates are neither plumbum corneum nor luna cornea.

2. *With Mineral alkali.* This combination produces long three-ſided columnar cryſtals, intermixed with ſome that are foliated. Theſe cryſtals do not deliqueſce in the air, and have a ſaline, bitter, and ſmoky taſte. They are leſs ſoluble than common ſalt, and melt with more difficulty than nitre. They do not become alkaline on burning coals, and, in their other properties, reſemble the former.

3. *With volatile alkali.* This ſalt ſhoots into acicular cryſtals, having a ſharp, ſaline, bitter, and cooling taſte; when heated in a ſilver ſpoon, they melt and evaporate entirely; in cloſe veſſels they ſublime. They do not precipitate ſolution of ſilver, nor change ſpirit of nitre into aqua-regia. A powerful antiſpaſmodic remedy is prepared from rectified ſpirit of hartſhorn and ſalt of amber.

4. *With lime.* This ſhoots into oblong pointed cryſtals, which do not deliqueſce in the air, and are ſoluble with difficulty even in boiling water; nor, according to Mr Stockar de Neuforn, can they be decompoſed by diſtillation either with acetous or marine acids. They detonate by diſtillation with nitrous acid; and are decompoſed, either in the moiſt or dry way, by the vitriolic. When mixed with common ſal ammoniac in the dry way, they ſuffer a decompoſition; the ſuccinated ammoniacal ſalt flying off and the combination of marine acid with lime remaining behind.

5. *With magneſia.* This yields a white, gummy, frothy, ſaline maſs, which acquires a yellowiſh colour when dried by the fire; and, when cool, deliquates in the air. It is decompoſed by alkalies and lime, as well as by the vitriolic acid.

6. *With clay.* By uniting the acid of amber with an edulcorated precipitate of alum with vegetable alkali, Wenzel obtained priſmatic cryſtals, which could not be decompoſed by alkalies.

7. *With ſilver.* The acid of amber has no effect on ſilver

Acid of amber and its combinations.

ſilver in its metallic ſtate; but with its precipitate forms thin oblong cryſtals, radiated and accumulated upon one another, from which the ſilver may be ſeparated by alkalies, by quickſilver, and by copper.

8. *With copper.* By a long digeſtion of copper with acid of amber a green ſolution is obtained, which by mixture with common ſalt is rendered turbid, by vitriolic acid white, and lets fall a green precipitate on the addition of fixed alkali. Wenzel, however, could not obtain this precipitation by alkalies. His ſolution yielded groups of green cryſtals, gave a cruſt of copper to zinc, and was precipitated by liver of ſulphur.

9. *With iron.* Wenzel diſſolved a precipitate of this metal in acid of amber, and from the ſolution obtained ſmall, brown, tranſparent, and ſtellated cryſtals. Zinc precipitated the metal, but not alkalies. From a ſlightly coloured ſolution of metallic iron, Pott obtained, by means of alkali, a white precipitate, which ſoon became yellow, and at length green, by pouring water upon it.

10. *With tin.* Acid of amber diſſolves tin when precipitated by a fixed alkali; and the ſolution yields thin, broad, and foliated tranſparent cryſtals. Alkalies throw down but little from this ſolution; liver of ſulphur more; and lead, iron, or zinc, nothing.

11. *With lead.* Acid of amber whitens the ſurface of lead in its metallic ſtate, but does not diſſolve it; neither can lead be precipitated from its ſolutions in nitrous and marine acids by ſalt of amber, though this is denied by Pott. According to Stockar, however, it forms a white precipitate with ſugar of lead. This metal precipitated by an alkali, and diſſolved in acid of amber, forms long foliated cryſtals lying upon one another; from the ſolution of which the lead may be precipitated by alkalies in the form of a grey powder, and by zinc in its metallic ſtate.

12. *Zinc*, in its metallic ſtate, is readily diſſolved by the acid of amber; and by a combination with the precipitate formed by fixed alkali, we obtain long, ſlender, foliated cryſtals, lying upon one another. The ſolution lets fall a white precipitate on the addition of fixed alkali; but this is denied by Stockar, who ſays that volatile alkali produces a red precipitate.

13. *Biſmuth.* By means of heat, Stockar obtained a ſolution of this ſemimetal in acid of amber, which was decompoſed by alkalies. Wenzel obtained, from a precipitate of biſmuth prepared by means of fixed alkali, ſmall, ſlender, foliated, and yellow cryſtals; which alkalies cannot decompoſe, though black precipitates are thrown down by lead and zinc.

14. *Regulus of antimony.* Little or none of this ſemimetal, in its reguline form, is diſſolved in the acid of amber; but it attacks the precipitate made with fixed alkali. This ſolution is very copiouſly precipitated by liver of ſulphur, but not by alkalies.

The combinations of this acid with gold, platina, nickel, arſenic, and mangancſe, have either been found impracticable, or not yet attempted; all thoſe above deſcribed are non-deliqueſcent, and part with their acid when expoſed to the fire. The elective attractions of this acid, according to Bergman, are ſingular, as it adheres more ſtrongly, not only to terra ponderoſa and lime, but to magneſia, than to fixed alkali.

Acid of amber and its combinations.

1495
On the nature of the acid of amber.

On the origin of ſalt of amber, Mr Keir remarks, that "it deſerves to be conſidered as a pure and diſtinct acid. No proofs have been adduced of its being a modification either of the marine or vegetable acids, as Mr Cornette and M. Hermbſtadt have ſuppoſed. The former, having diſtilled ſpirit of ſalt with oil of lavender, obtained an acid which ſmelled like ſalt of amber, but on examination was found to retain the properties of the muriatic acid. He alſo relates, that, when purifying a conſiderable quantity of the ſalt of amber which he had prepared himſelf, ſome ſea-ſalt was ſeparated, which in the diſtillation had ariſen along with it. But this obſervation cannot be juſtly applied to ſhow any reſemblance betwixt theſe two, any more than the ſmell in the former caſe could ſhow an analogy betwixt it and oil of lavender. This mixture of ſea-ſalt with acid of amber, however, may readily explain the miſtake of M. Bourdelin already mentioned. M. Weſtrumb and M. Hermbſtadt have both laboured in vain to convert the acid of amber into acids of ſugar and tartar by frequent diſtillations with ſpirit of nitre; and their want of ſucceſs confirms the account already given, that the acids of nitre and amber have no action upon each other, farther than that the former is phlogiſticated or changed into red fumes, and the latter becomes whiter. Nevertheleſs, if Mr Scheele's obſervation of the identity of the acid liquor, which comes over in the diſtillation of amber with acetous acid, holds good, we ſhall have the beſt reaſon yet given to aſcribe the origin of this acid to the vegetable kingdom; and when we conſider the very different properties that are aſſumed by the vegetable acids, which, however, are convertible into one another, no reaſon can be drawn from the diverſity of its properties with thoſe of other vegetable acids, againſt its having a common origin with them. Indeed the natural hiſtory of amber, its ſimilarity to gums and reſins, and its involved inſects, afford other arguments in favour of the opinion.

IX. *Acid of Arsenic.*

1496
M. Pelletier's method of procuring the arſenical acid.

M. Berthollet remarks upon Mr Scheele's proceſs, that during the operation a great quantity of dephlogiſticated air is expelled from the acid. M. Pelletier has found another method of procuring the arſenical acid. He mixes common white arſenic with nitrous ammoniac, and diſtils the mixture. At firſt phlogiſticated nitrous acid paſſes over, then the volatile alkali, and laſtly the arſenical acid remains in the retort in form of a vitreous maſs, which deliqueſces into a very denſe acid liquor, reddening ſyrup of violets, and efferveſcing with alkalies. Mr Macquer had formerly deſcribed this proceſs, and obſerved, that the nitrous acid paſſes over firſt, and then the volatile alkali; but was of opinion that the reſiduum was nothing but arſenic. He mentions a detonation which took place in his experiment; but nothing of this kind was obſerved by M. Pelletier: he only informs us, that the nitrous acid was driven over with great violence, while that of arſenic united with the volatile alkali. M. Berthollet, who has endeavoured to aſcertain the weight gained by the converſion of ſulphur, phoſphorus, and arſenic, into acids, determines that of arſenic to be about one-ninth of the whole. At the ſame time he obſerves, that this additional weight does not diſcover the whole weight of the air contained in the arſenic, as it had that neceſſary to convert it into calx before the operation of converting it into an acid was begun. On the other hand, M. Bergman aſſerts, that one-fifth of white arſenic is phlogiſton, and that this calx is converted into acid merely by being deprived of its phlogiſton. Thus the *facts* related by theſe two celebrated chemiſts differ enormouſly from one another, M. Berthollet affirming that the arſenic *gains* a ninth of its original weight in the proceſs of acidification; and M. Bergman, that it *loſes* a fifth part of the ſame. M. Berthollet endeavours to reconcile this, by ſuppoſing that Bergman had employed marine acid for the preparation of his arſenical acid, which is well known to cary off with it ſome part of moſt of thoſe ſubſtances with which it is capable of combining; and so this he attributes the loſs of weight in Bergman's proceſs.

IX. *Acid of Molybdæna.*

1497 M. Pelletier's experiments.

The opinion of M. Bergman concerning the metallic nature of the acid of molybdæna has obtained ſome confirmation from the experiments of M. Pelletier. He was not able indeed to obtain any regulus; but by means of oil alone he procured, by two hours vehement heat, a ſubſtance ſlightly agglutinated with a metallic luſtre, containing ſmall round grains of a grey metallic colour, very viſible by the help of a magnifier. Theſe he ſuppoſes to have been a true regulus of molybdæna; which he found to poſſeſs the following properties. 1. It is calcinable by fire into white calx. 2. It detonates with nitre, and the reſiduum is a calx of molybdæna united with the alkali of the nitre. 3. It is converted into a white calx by means of nitrous acid. 4. It yields inflammable air when treated with alkalies in the dry way, and forms peculiar compounds with them. 4. It forms regenerated molybdæna with ſulphur. 6. It unites, and forms peculiar ſubſtances with metals. By uniting it with ſilver, iron, and copper, we have friable reguline maſſes; and refractory powders with lead and tin.

Our author, in conſequence of his experiments, conſiders molybdæna as a metallic ſubſtance mineralized by ſulphur; and the earth called the acid of molybdæna as a calx much dephlogiſticated, which has retained part of the air contained in the nitrous acid. He obſerves likewiſe an analogy betwixt molybdæna and antimony in their chemical reſults. Both of them yield vitrifiable argentine flowers by ſimilar operations, and both are changed into white earths by nitrous acid; but they differ in the two following reſpects. 1. The latter eaſily gives a fuſible regulus; but the molybdæna ſeems to be the moſt refractory of all the ſemimetals. 2. The calx of regulus of antimony is ſoluble by alkalies in the moiſt way, but that of molybdæna is not.

X. *Acid of Tungsten or Wolfram.*

1498 Properties of tungſten.

Mr Luyart, who has examined this mineral, gives the following account of it. 1. It is infuſible by the blow-pipe, though the angles of the pieces into which it is broken are thereby rounded. 2. It efferveſces with microcoſmic ſalt, and melts before the blow-pipe into a reddiſh glaſs. 3. With borax it efferveſces; and by the outward flame of the blow-pipe is changed into a reddiſh glaſs; by the internal flame into a greeniſh one. 4. Heated by itſelf in a crucible, it ſwelled, became ſpongy, ſemivitrified, and was attracted by the magnet. 5. With an equal part of nitre it detonated, or boiled up with a blue flame round the edges, and nitrous vapours aroſe. The maſs was ſoluble in water, and let fall a white precipitate with acid. 5. It melted readily with fixed alkali, leaving a kind of black matter in the crucible, and a ſmaller quantity of lighter coloured ſubſtance on the filter. Theſe reſiduums ſhowed a mixture of iron and manganeſe. 6. With nitrous acid the filtered ſolution let fall a white precipitate, at firſt ſweet, but afterwards bitteriſh and ſharp, and which cauſed a diſagreeable ſenſation in the throat; and the acidity of the ſolution of it was manifeſt, by its turning the tincture of turnſole red.

Having examined the ſubſtance by means of liquids in Mr Scheele's way, they obtained the ſame yellow powder which he had characterized as the acid of tungſten, along with a very ſmall reſiduum, which appeared to contain a mixture of tin. Proceeding farther in the analyſis, they found that wolfram is compoſed of manganeſe, calx of iron, the yellow matter called the *acid of tungſten* by Bergman and Scheele, with a very little mixture of quartz and tin, and which they conſidered as accidental.

1499 Of the yellow matter, called its acid by Mr Scheele.

They now proceeded to examine the yellow matter, ſuppoſed by the two celebrated chemiſts juſt mentioned to be a ſimple acid ſalt, but which turned out very different on their inquiries. In order to procure a quantity of it, they melted ſix ounces of wolfram with as much vegetable alkali, diſſolved the mixture in diſtilled water, filtrated the liquor, and evaporated it to dryneſs. Thus they obtained a white ſalt; upon which, when dry, they poured nitrous acid, and ſet it to boil in a ſand-bath; by which operation it became yellow. They then decanted the liquor, pouring freſh acid upon the reſiduum; and repeated the operation a third time in order to deprive it of all the alkali. The remaining powder was then calcined in a cupelling furnace under a muffle, when it came out quite pure and yellow. The properties of it were then found to be as follow. 1. It is entirely inſipid, and of the ſpecific gravity of 6.12. 2. Before the blow-pipe, it continues yellow in the exterior flame even though put on charcoal; but grows black and ſwells, though it does not melt, in the internal flame. 3. In the internal flame it forms a blue tranſparent glaſs with microcoſmic ſalt. The colour vaniſhes in the external flame, but appears again in the internal one; but by a continuance of this operation, it at laſt loſes its colour ſo much that it cannot be recovered. 4. It efferveſces, and forms a browniſh yellow tranſparent glaſs with borax, which keeps its colour in both flames. 6. When triturated with water, it forms an emulſion which paſſes through filters without becoming clear, and continues a long time without any depoſition. 7. It is inſoluble in acids, but diſſolves readily in the vegetable alkali both in the moiſt and dry way; though the produce has always an exceſs of alkali. 8. On adding nitrous acid in greater quantity than what is neceſſary to ſaturate this exceſs, a white powder falls, which is the ſame with the acid of tungſten diſcovered by Mr Scheele; but which Meſſrs Luyarts will

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No ſimple acid procurable from tungſten.

not allow to be a ſimple acid, though they admit that it contains one; and affirm, that its properties are various according to the circumſtances of its precipitation. The properties of it, as deſcribed by them, are the following. 1. It is fuſible before the blow-pipe, exhibiting the ſame phenomena as the yellow matter. 2. By calcination in a little pot or teſt, it emits the ſmell of nitrous acid, and turns yellow; but, on cooling, remains white, inſipid, and inſoluble; and this reſiduum melts by itſelf before the blow-pipe. 3. A yellow colour is produced either by vitriolic or marine acids; and the filtrated liquor affords a neutral ſalt with baſis of fixed alkali, according to the nature of the acid employed. If the vitriolic acid is employed, and the operation performed in a retort, a quantity of nitrous acid paſſes over. 4. If, inſtead of pouring the acid on the ſalt, it be poured upon its ſolution, no precipitate will be formed, not even by making the liquor boil, if the quantity of acid is ſmall; only the ſolution loſes its ſweet taſte, and acquires more bitterneſs. On pouring on a large quantity of acid, and cauſing the liquor boil, a yellow precipitate is formed in every reſpect ſimilar to the yellow matter ſo often mentioned. 5. This ſalt is completely diſſolved by the boiling with vinegar. On leaving the ſolution to cool, a white waxy matter adheres to the ſides of the veſſel; which being waſhed and kneaded with the fingers, forms an adheſive maſs like bird-lime, having a fat and greaſy taſte. By expoſure to the air it acquires a dark grey colour, loſes its adheſive property, and becomes bitter. It diſſolves in water; and gives at firſt a ſweet, then a bitter taſte, making the tincture of turnſole red. 6. On evaporating the alkaline ſolution to dryneſs, pouring acetous acid upon the reſiduum, and then making it boil, the greater part of the reſiduum, was diſſolved, and on cooling afforded feathery cryſtals. Theſe when edulcorated had a ſweet taſte, though leſs ſtrong than that of the former ſalt, which afterwards became bitter. Their ſolution turned blue paper red; was precipitated, and became like an emulſion with ſpirit of wine; and the reſiduum, which did not diſſolve, appeared to be of the ſame nature. The cryſtals diſſolved in freſh acetous acid, and communicated a blue colour to the acid; but this gradually diſappeared on cooling, and a glutinous matter was depoſited on the ſides of the veſſel, which had the properties of the former ſubſtance of that ſort. If, in place of letting the ſolution cool, it ſhould be kept boiling, the blue colour diſappears, and nothing is precipitated. By adding ſpirit of wine when the liquor is almoſt evaporated to dryneſs, a white powder is precipitated; which after being edulcorated with freſh ſpirit of wine, taſtes exceedingly bitter, and is very ſoluble in water. This ſolution, however, does not redden blue paper, nor make a blue with vinegar. With vitriolic acid its ſolution is blue; with vitriol of copper it forms a white precipitate. All theſe ſalts, by calcination, firſt become blue, then yellow, and laſtly white. 7. On pouring a quantity of lime-water upon the ſolution of the precipitate formed by the nitrous acid, as well as on thoſe obtained by the acetous acid, white precipitates were formed, all of which were a true regenerated tungſten. Having afterwards impregnated the liquors with fixed air, and boiled them in order to precipitate the lime more completely, they found in the ſolutions, after they were filtrated and evaporated to dryneſs, neutral ſalts formed of the precipitating acids, joined with alkaline and calcareous baſes. This proved, that both alkali and acid were concerned in the precipitation. 8. On pouring the vitriolic ſolutions of iron, copper, and zinc, as well as that of marine mercurial ſalt, alum, and Pruſſian alkali, upon the ſolution of the precipitate formed by the nitrous acid, no precipitation enſues, and the acetous ſalts of copper and lead give white precipitates; but the Pruſſian alkali forms no precipitate with the acetous ſalts. Hence it appears that this ſalt is not a ſimple acid, but rather a ſalt compoſed of the yellow matter, fixed alkali, and the precipitating acid; and its compoſition appears more fully from the following experiments with the volatile alkali.

1. The yellow powder diſſolves entirely in volatile alkali, but without any perfect ſaturation taking place; and the alkali always prevails. 2. The ſolution being ſet in a ſand-bath, produced needle-like cryſtals, which had a ſharp bitter taſte, exciting a diſagreeable ſenſation in the throat. Their ſolution turned the tincture of turnſole red, and the liquor from which they were cryſtallized had the ſame properties. 3. Having repeated this operation with different quantities of the ſame cryſtals, leaving ſome longer on the fire than others, ſolutions were obtained, whoſe acidity was in proportion to the time they had remained on the fire; but during the operation they all emitted the ſmell of volatile alkali. By calcination this alkali was entirely diſſipated, and the reſiduum was a yellow powder, perfectly ſimilar to that with which the operation was begun. On making uſe of a retort for the operation, the remaining powder was blue. 4. This ſalt precipitates the vitriolic ſalts of iron, copper, zinc, and alum, calcareous nitre, marine mercurial ſalt; the acetous ſalts of lead and copper; and with lime-water regenerates tungſten. The vitriolic acid decompounds it, and forms a blue precipitate; the nitrous and marine acids produce a yellow; but no precipitate is occaſioned by the Pruſſian alkali.

Having poured nitrous acid upon a portion of the ſolution with exceſs of alkali, a white powder was precipitated, which, after edulcoration, had a taſte at firſt ſweet, but afterwards ſharp and bitter, and its ſolution turned the tincture of turnſole red. This, on examination, appeared to be a triple ſalt formed of the yellow powder, volatile alkali, and the precipitating acid.

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A kind of ſemimetal procurable from tungſten.

The following experiments realize the conjecture of Bergman, that the acid of tungſten is the baſis of a particular ſemimetal.

1. "Having kept 100 grains of the yellow powder (ſays M. Luyart) in a Zamora crucible well covered, and ſet the whole in a ſtrong fire for half an hour, it became a ſpongy maſs of a bluiſh black colour, the ſurface of which was cryſtallized into fine points, like plumoſe antimony, and the inſide compact, and of the ſame colour. It was too hard to be broken in pieces by the fingers; and, when ground, was reduced to a dark-blue colour.

2, "Having mixed 100 grains of the ſame powder with 100 of ſulphur, and put the mixture in a Zamora crucible on a ſtrong fire for a quarter of an hour, it came out a dark-blue maſs, which was eaſily broke by the fingers; and the inſide preſented a cryſtallization like needles as the laſt, but tranſparent, and of the colour of a dark lapis lazuli. This maſs weighed 42 grains, and when placed on burning coals yielded no ſmell of ſulphur.

3. "Having put another 100 grains of this powder into a Zamora crucible, provided with charcoal, and well covered, and placed it in a ſtrong fire, where it remained an hour and a half, we found, on breaking the crucible after it was cool (A), a button, which fell to powder between the fingers. Its colour was dark brown; and on examining it with a glaſs, there was ſeen a congeries of metallic globules, among which ſome were the bigneſs of a pin's head, and when broke had a metallic appearance at the fracture in colour like ſteel. It weighed 60 grains: of courſe there was a diminution of 40. Its ſpecific gravity was 17.6. Having calcined part of it, it became yellow, with $\frac{24}{100}$ increaſe of weight. Having put one portion of this ſubſtance powdered, in digeſtion with the vitriolic acid, and another with the marine acid, neither of them ſuffered more diminution than $\frac{1}{160}$ of their weight; then decanting the liquor, and examining the powder with a glaſs, the grains were ſtill perceived of a metallic aſpect. Both the acid liquors gave a blue precipitate with the Pruſſian alkali, which let us know that the ſmall diminution proceeded from a portion of iron which the button had undoubtedly got from the powder of the charcoal in which it had been ſet. The nitrous acid, and aqua-regia extracted likewiſe from two other portions the ferruginous part; but beſides, they converted them into yellow powder, perfectly ſimilar to that which he uſed in this operation.

4. "Having put 100 grains of gold and fifty of the yellow powder in a Zamora crucible furniſhed with charcoal, and kept in a ſtrong fire for three quarters of an hour, there came out a yellow button which crumbled in pieces between the fingers; the inſide of which ſhowed grains of gold, ſeparated from others of a dark-brown colour. This demonſtrated there had not been a perfect fuſion and likewiſe that this ſubſtance was more refractory with gold, ſince the heat which it endured was more than ſufficient to have melted it. The button weighed 139 grains; of courſe there was a diminution of 11 grains. Having put this button with lead in the cupelling furnace, the gold remained pure in the cupel; but this operation was attended with conſiderable difficulty.

5. "Having made a mixture of platina and yellow powder in the preceding proportions, and expoſed it to a ſtrong fire, with the ſame circumſtances, for an hour and a quarter, it produced a button which crumbled with eaſe between the fingers, and in which the grains of platina were obſerved to be more white than uſual, and ſome of them changed ſenſibly in their figure. This button weighed 140 grains, and of conſequence there had been a loſs of 10 grains. When calcined, it took a yellow colour, with very little increaſe of weight; and after waſhing it to ſeparate the platina, there remained 118 grains of a black colour. Having placed this portion again to calcine over a ſtrong fire in a muffle, it ſuffered no ſenſible alteration in weight or colour; for it neither grew yellow, nor took the brown colour of the platina, but kept the ſame blackneſs as before it was calcined. It muſt be attended to, that in the waſhings there was not ſo much care taken to collect all the platina as to deprive it of the yellow colour, and for this reaſon the water carried off part of the fine black powder: and conſequently the increaſe which the platina preſerved, after being waſhed and calcined the ſecond time, ought to be computed more than the 18 grains which it ſhowed by its weight.

"Having mixed the yellow powder with other metals in the preceding proportions, and treated them in the ſame manner, the reſult was as follows:

6. "With ſilver it formed a button of a whitiſh-brown colour, ſomething ſpongy, which with a few ſtrokes of a hammer extended itſelf eaſily, but on continuing them ſplit in pieces. This button weighed 142 grains, and is the moſt perfect mixture we have obtained, except that with iron.

7. "With copper it gave a button of a copperiſh red, which approached to a dark brown, was ſpongy, and pretty ductile, and weighed 133 grains.

8. "With crude or caſt-iron, of a white quality, it gives a perfect button, the fracture of which was compact, and of a whitiſh brown colour: it was hard, harſh, and weighed 137 grains.

9. "With lead it formed a button of a dull dark-brown, with very little luſtre: ſpongy, very ductile, and ſplitting into leaves when hammered: it weighed 127 grains.

10. "The button formed with tin was of a lighter brown than the laſt, very ſpongy, ſomewhat ductile, and weighed 138 grains.

11. "That with antimony was of a dark-brown colour, ſhining, ſomething ſpongy, harſh, and broke in pieces eaſily: it weighed 108 grains.

12. "That of biſmuth preſented a fracture, which, when ſeen in one light, was of a dark-brown colour, with the luſtre of a metal; and in another appeared like earth, without any luſtre: but in both caſes one could diſtinguiſh an infinity of little holes over the whole maſs. This button was pretty hard, harſh, and weighed 68 grains.

13. "With mangaueſe it gave a button of a dark bluiſh-brown colour and earthy aſpect; and on examining the internal part of it with a lens, it reſembled impure drops of iron: it weighed 107 grains."

XI. *Acid of Ants.*

Etmuller is among the firſt authors who mentions the exiſtence of this acid, and ſpeaks of obtaining it by diſtillation. Nothing of its properties, however, was known, until Margraaf undertook to examine it; of whoſe experiments we have an account in the Memoirs of the Berlin Academy for 1749. Since his time a number of chemiſts have proſecuted the ſubject to

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(A) "The firſt time we made this experiment, we broke the crucible without letting it cool entirely; and as ſoon as the matter was in contact with the air, it took fire, and its dark brown colour turned inſtantly yellow."

to a conſiderably greater length; but Mr Keir prefers the reſearches of Arvidſon, Bucholtz, and Hermbſtadt, to the reſt.

The acid in queſtion is a natural juice which the inſects diſcharge when irritated, and which is very pungent to the ſmell as well as taſte. Thus it may inſtantly be perceived on turning up an ant-hill in ſpring or ſummer. The *formicæ rubræ* of Linnæus are thoſe inſects which have hitherto ſupplied this acid. Mr Arvidſon adviſes to collect them in the months of June and July, by laying ſome ſmooth ſticks upon an ant-hill; which being then diſturbed, the ants will run upon the ſticks in great numbers, and may then be ſwept off into a veſſel containing water until it be full. Hermbſtadt collects them in the ſame manner, but into a dry bottle, to avoid the evaporation of the ſuperfluous liquid. Bucholtz having moiſtened the inſide of a narrow necked glaſs bottle with honey and water, ſunk it into a diſturbed ant-hill until the mouth was level with the ground; on which the inſects, allured by the ſmell of the honey, went into the bottle, and could not get out.

1502 Different methods of obtaining this acid.

For obtaining the acid, Margraaf employed diſtillation, with the addition of freſh water. Thus he obtained, from 24 ounces of freſh ants, 11 ounces and two drachms of acid, ſome volatile alkali, empyreumatic oil, and a reſiduum containing earth and fixed ſalt. Arvidſon made uſe of two methods: One conſiſted in diſtilling the ants when dry; from a pound of which, in this ſtate, he obtained eight ounces of acid beſides the empyreumatic oil. His other method was to incloſe, in a piece of linen, the ants previouſly cleaned by waſhing in water, then to pour boiling water upon them, and to repeat the operation until it could extract no more acid; which is then obtained by ſqueezing the linen, mixing all the liquors, and filtering them. Thus from a pound of ants he obtained a quart of acid liquor, which taſted like vinegar, but was ſpecifically heavier. By diſtillation Hermbſtadt obtained from a pound of dry ants ten ounces and a half of yellow empyreumatic liquor, which did not taſte more ſtrongly acid than the ſpirit obtained by diſtilling wood, on which ſwam three drachms of a brown fetid oil, in all reſpects like that of hartſhorn. In the retort was left a black reſiduum weighing one ounce ſix drachms, which exhibited ſigns of containing volatile alkali. By diſtilling a pound of ants with three of water, according to Mr Margraaf's method, he obtained an acid liquor and ſome oil in the receiver; and from the ſurface of that which remained undiſtilled, he collected a drachm and an half of fat oil.

The ſpecific gravity of the acid liquor obtained by Mr Arvidſon's maceration was 1,0011; that of the ſame liquor, when diſtilled, 1.0075; and of the acid concentrated by freezing, 1.0453. According to Bucholtz, the acid liquor thus obtained by maceration did not grow in the leaſt mouldy in the ſpace of four weeks; during which it was allowed to reſt in order to free itſelf perfectly from the impurities it contained. Mr Hermbſtadt, however, prefers Margraaf's method of diſtillation to that of Arvidſon's macerations, not only as being a more perfect analyſis, but as leſs laborious; though he finds fault alſo with Margraaf's method, as diluting the acid too much, and altering it ſo that it has not the ſmell of living ants. He totally diſapproves of the method of diſtilling dried ants, as the acid is thus in a great meaſure decompoſed, and the remainder united with much oil. To avoid all theſe inconveniences, he contrived another method, namely, to expreſs the juice of the inſects; by which means he obtained at once a concentrated liquor fit for diſtillation. In this way he obtained from two pounds of dried ants 21 ounces and two drachms of juice, which had a pungent and highly acid ſmell, reſembling the vapours of fluor acid, in taſte reſembling concentrated vinegar and acid of tartar; to which laſt it might be compared for ſtrength of acidity. By diſtilling eight ounces of this expreſſed liquor, he obtained ſix ounces and a half of clear acid, equal in ſtrength to a very concentrated vinegar.

1503 Properties of the pure acid.

The acid, when thus procured in purity, has a pungent, not unpleaſant ſmell, a ſharp, cauſtic taſte, and an agreeable acidity. It reddens blue paper, ſyrup of violets, and litmus; blackens the vitriolic acid, and converts part of it into a ſulphureous vapour. It is alſo decompoſed by diſtillation with nitrous acid. Spirit of ſalt likewiſe, when dephlogiſticated, decompoſes it, but not in its ordinary ſtate. It does not form ſulphur by an union with phlogiſton, but produces inflammable vapours by diſſolving iron or zinc. By the aſſiſtance of a gentle heat it diſſolves ſoot, but oils with much more difficulty, and powder of charcoal not at all. It does not unite with vitriolic ether; but in diſtilling a mixture of this acid with ſpirit of wine, Mr Arvidſon ſaw ſome traces of an ether, and M. Bucholtz perfectly ſucceeded in making an ether by means of it. It unites with fixed alkali, forming, according to M. Margraaf, a neutral ſalt, conſiſting of oblong deliqueſcent cryſtals, from which very little acid could be procured by diſtillation *per ſe*, but on adding concentrated oil of vitriol, a very ſtrong and pure acid was obtained; from a mixture of which with ſpirit of wine, M. Bucholtz readily obtained a true ether. With mineral alkali it forms deliqueſcent foliated cryſtals of a ſaline bitter taſte, and ſoluble in twice their weight of water. With volatile alkali it forms an ammoniacal liquor; which, according to Arvidſon, cannot be brought into a dry ſtate; but Mr Arvidſon ſays he has obtained cryſtals from it, though very thin and deliqueſcent. Margraaf obtained dry cryſtals by uniting this acid, with chalk or coral; and Arvidſon obſerves that this ſalt is tranſparent, cubical, or rhomboidal, nondeliqueſcent, ſoluble in eight parts of water, of a bitter taſte, and inſoluble in ſpirit of wine. No acid can be obtained from it by diſtillation *per ſe*. From a ſolution of magneſia in this acid, Mr Arvidſon obtained ſome ſaline particles by depoſition, and afterwards an effloreſcence of tranſparent ſalt riſing round a ſaline maſs. This ſalt had ſcarcely any taſte, was ſoluble in 12 parts of water, and inſoluble in ſpirit of wine. With ponderous earth the acid formed a cluſter of bitter needle like cryſtals, which did not deliqueſce, were ſoluble in four times their quantity of water, inſoluble in ſpirit of wine, and when burnt gave out a ſmell like that of burnt ſugar, leaving a coal which efferveſced with acid. It unites with difficulty to the earth of alum, and can ſcarcely be ſaturated with it. It does not precipitate ſilver, lead, or mercury, from their ſolution in nitrous acid; whence it ſeems to have no affinity to the marine acid: and as it does not precipitate lime from the marine acid, it ſeems to have as little with the vitriolic. From his experiments, however, Margraaf concluded, 1504 Has an affinity with the acetous acid. that the acid of ants, in many reſpects, though not in all, has a great affinity with the acetous acid. From this it is diſtinguiſhed by forming different compounds, and likewiſe by having different affinities. It diſlodges the acetous acid alſo in all inſtances, and the arſenical acid from cobalt and nickel. It has a greater attraction for fixed alkalies than for lime.

1505 Its effects on metals. As a ſolvent it acts but weakly upon copper; not at all, or very little, on ſilver, lead, tin, regulus of antimony, or biſmuth, but ſtrongly on iron or zinc. It diſſolves, however, the calces of copper, ſilver, zinc, and lead, without affecting thoſe of tin, regulus of antimony, or biſmuth. The calx of quickſilver, according to Margraaf, is revived by it. According to Arvidſon, it cryſtallizes with iron, zinc, or lead; does not act upon the regulus of antimony, of arſenic, cobalt, or nickel; though it diſſolves their calces as well as the precipitate of manganeſe. Gold, mercury, and the calx of platina, are not affected by it; but it cryſtallizes with thoſe of copper, ſilver, lead, biſmuth, and mercury.

In its ſtrength of attraction, the acid of ants exceeds thoſe of vinegar, borax, and the volatile ſulphureous and nitrous acids. 1506 Acid procured from various inſects. Inſects armed with ſtings, as bees, waſps, and hornets, are likewiſe ſaid to diſcharge a very acid juice when irritated; and Mr Bonnet has obſerved a very ſtrong acid ejected by a caterpillar which he diſtinguiſhes by the name of *grande chenille du ſaule a queu fourchue*. None of theſe, however, have been as yet particularly examined.

XII. *Acid of Apples.*

That the juices of unripe fruits contain ſome kind of acid has been univerſally known, and attempts to inveſtigate the nature of it have been made ſome time ago: but it is to Mr Scheele that we owe the diſcovery of the particular acid now treated of. 1507 Acid of citrons how procured. He had obſerved that the juice of citrons contained a particular acid; which, by being united with lime, formed a ſalt very inſoluble in water; and which therefore by means of lime could be readily ſeparated from the mucilaginous part of the juice. By adding vitriolic acid to this compound of lime with the acid juice, almoſt in the ſame manner in which he uſed to procure the acid of tartar, the lime was again ſeparated, and the pure acid of citrons obtained. Proceeding in the ſame manner with other fruit, he found that an acid, agreeing in every reſpect with that of citrons, could be procured from the juice of the *ribes groſſularia*. Examining the juice which remained after the ſeparation of the former acid from the citrons, he found that it ſtill contained another acid; which being ſaturated with more calcareous earth, formed a ſalt 1508 Another acid procured from the juice of fruits. eaſily ſoluble in water, and therefore remained ſuſpended in the juice. To ſeparate this new ſalt, he added ſome ſpirit of wine, by which the ſalt was precipitated; but finding that it ſtill contained much gummy matter, he judged that it would be proper to attempt a ſeparation of this gum before he precipitated the ſalt. For this purpoſe he evaporated ſome of the juice of the ribes groſſularia to the conſiſtence of honey, diſſolving the maſs afterwards in ſpirit of wine. Thus the acids, which are ſoluble in the ſpirit, were eaſily ſeparated by filtration from the inſoluble gum. He then evaporated the ſpirit, adding to the remainder twice its quantity of water, with as much chalk as was neceſſary for the ſaturation. The liquor was next boiled for two minutes; during which the inſoluble ſalt was precipitated, and the liquor ſeparated from it by filtration contained the ſolution of chalk in the new acid. To this ſolution he added ſpirit of wine, which again precipitated the ſalt, while ſome ſaponaceous and ſaccharine matters remained diſſolved in the ſpirit.

1509 Its properties. Having thus at laſt obtained the ſalt in a ſtate of purity, he proceeded to examine its nature; and found, 1. That ſome of it, ſpread on his nail, ſoon dried, and aſſumed the appearance of varniſh. 2. It was very ſoluble in water, and turned litmus red. 3. When the ſolution had ſtood ſome days expoſed to air, it was found to have depoſited a number of ſmall cryſtals, which could only be diſſolved by a quantity of boiling water; and this ſalt was alſo found to be completely neutralized, ſo that, it yielded its calcareous earth to a fixed alkali. 4. The ſalt was decompoſed by heating *per ſe* in a crucible, and left a mild calcareous earth. 5. The acid was ſeparated from the earth by adding oil of vitriol diluted with water until gypſum was no longer precipitated, and the new acid was left diſengaged, ſo that it could be ſeparated by filtration. 6. By this operation, however, all the lime was not precipitated; ſo that the ſeparation of the acid was not complete. 7. He obſerved that the acid had a greater attraction for lead than for lime; and therefore made uſe of the method he had formerly diſcovered for ſeparating the acid of ſorrel. To the acid he added a ſolution of ſugar of lead; by which the acid was precipitated along with the lead, and the vinegar was left 1510 How procured in perfect purity. in the liquor. To this precipitate, cleaned from the acetous acid by filtration, he added vitriolic acid, which expelled the weaker vegetable one, and thus left it quite pure and free from any heterogeneous mixture.

The juice of apples, either ripe or unripe, was found to contain no acid of citrons, but a large quantity of the new acid; which, being thus alone, he could more eaſily procure by a ſingle operation. The beſt method of procuring this he found to be by ſaturating the juice of the apples with a ſolution of fixed vegetable alkali, and pouring a ſolution of ſugar of lead to that of the ſalt juſt mentioned. The effect of this was a double decompoſition, and a precipitate of lead combined with the new acid. To the edulcorated precipitate he then added a dilute vitriolic acid till he could no longer perceive any ſweet taſte in the liquor; for the firſt portions of the vitriolic acid diſſolve a part of the calx of lead, and impart a ſweetiſh taſte to the liquor, which is ſenſible, notwithſtanding its acidity; but when the quantity of vitriolic acid is ſufficient to ſaturate the whole of the calx, all the metal falls to the bottom, and the ſweetneſs ceaſes; ſo that the acid is at once obtained pure.

1511 Properties of it when obtained from the juice of apples. The acid of apples is poſſeſſed of the following properties. 1. It cannot be cryſtallized, but always remains in a liquid ſtate; or, if much evaporated, attracts the moiſture of the air. 2. With fixed alkalies of all kinds it forms deliqueſcent ſalts. 3. With calcareous earth it forms ſmall irregularly ſhaped cryſtals, which cannot be diſſolved but in a large quantity of boiling water; but if the acid is ſuperabundant, the ſalt readily diſſolves in lime-water. 4. It is effected by ponderous, earth in the ſame manner as by lime. 5. Earth of alum forms, with the acid of apples, a ſalt not very ſoluble in water. 6. With magneſia the acid forms a deliqueſcent ſalt. 7. Iron is diſſolved into a brown liquor, which does not cryſtallize. 8. The ſolution of zinc affords fine cryſtals. 9. On other metals it has no remarkable effects. From the acid of citrons it differs. 1. The acid of citrons ſhoots into fine cryſtals. 2. The acid of apples can be eaſily converted into that of ſugar, which Mr Scheele could not accompliſh with that of citrons; though Mr Weſtrumb has ſince done it. 3. The ſalt formed with the citron acid and lime is almoſt inſoluble in water; but that with acid of apples and lime is eaſily ſoluble. 4. Acid of apples precipitates mercury, lead, and ſilver from their ſolution in nitrous acid, and likewiſe the ſolution of gold, when diluted with water; but the acid of citrons does not alter any of theſe ſolutions. 5. The acid of citrons ſeem to have a greater attraction for lime than that of apples.

1512 Produced from ſugar by means of nitrous acid.

It is remarkable that this acid is the firſt produced in the proceſs for making ſugar. If a diluted acid of nitre be drawn off from a quantity of ſugar until the mixture becomes a little brown, which is a ſign that all the nitrous acid is evaporated, the ſyrup will be found to have acquired a ſouriſh taſte; and if, by means of lime, we next ſeparate all the acid of ſugar, another will ſtill remain, which diſſolves the calcareous earth. When this acid is ſaturated with chalk, and the ſolution filtered and mixed with ſpirit of wine, a coagulation takes place. On ſeparating the curdled part by means of a ſieve, diſſolving it in water, and then adding ſome vinegar of lead, the clax of lead will be precipitated; and if the new acid is then ſeparated from the metal by means of diluted oil of vitriol, it will be found to poſſeſs all the properties of the acid of apples, and is indeed the ſame. The ſpirit of wine, which has been employed to precipitate the calcareous ſalt, leaves on evaporation a reſiduum of a bitter taſte, very deliqueſcent, and ſimilar to the ſaponaceous extract of the citron.

1513 Experiments with nitrous acid on various ſubſtances.

The following are the reſults of Mr Scheele's experiments with the nitrous acid upon different ſubſtances. 1. From gum arabic he obtained both the acid of apples and of ſugar. 2. The ſame products were obtained from manna. 3. From ſugar of milk he obtained not only its own peculiar acid, but thoſe of apples and ſugar. 4. Gum tragacanth, during its ſolution in nitrous acids, lets fall a white powder, which was found to be the acid of the ſugar of milk. This gum contained alſo the acid of apples and of ſugar, and a ſalt formed from lime and the acid of apples. 5. Starch left an undiſſolved matter; which being ſeparated by filtration, and waſhed, reſembled a thick oil like tallow, which, however, was found to be very ſoluble in ſpirit of wine. By diſtillation he obtained from this oily matter an acid ſimilar to that of vinegar, and an oil which has the ſmell of tallow, and congeals by cold; and, beſides theſe ſubſtances, he found that ſtarch yielded the acids of apples and ſugar. 6. From the root of ſalep he obtained the acid of apples, with a large quantity of calcareous ſaccharine ſalt. 7. Extract of aloes indicated the exiſtence of the acids of ſugar and apples, and loſt the greateſt part of its bitter taſte. During the digeſtion a reſinous matter was ſeparated, which ſmelled like flowers of benzoin, and took fire on being heated in a retort. 8. Extract of colocynth was converted by nitrous acid into a reſinous ſubſtance, and ſhowed ſome ſigns of containing acid of ſugar. 9. The extracts of Peruvian bark and of the other plants examined by Mr Scheele, gave both the acids of apples and ſugar. 10. Theſe two acids were likewiſe obtained from an infuſion of roaſted coffee, evaporated to the conſiſtence of a ſyrup. 11. The ſame products were obtained from an extract of rhubarb, which yielded alſo a reſinous matter. 12. Juice of poppies afforded the ſame reſults. 13. Extract of galls did the ſame. 14. The eſſential oils afforded little or none of the acids; but the oil of parſley-ſeeds ſeemed to be entirely convertible into them. 15. With a very concentrated acid he was able alſo to decompoſe animal ſubſtances. From glue he thus obtained fine cryſtals of acid of ſugar, and afterwards acid of apples. Iſinglaſs, whites and yolks of eggs, afforded the ſame products. From all theſe ſubſtances, eſpecially the laſt, a fat matter was ſeparated: but it was remarkable that the gas, expelled during the proceſs, was compoſed of a little fixed air, a great quantity of phlogiſticated air, and very little nitrous air, whereas no phlogiſticated air is obtained in the uſual proceſs for preparing acid of ſugar. He obſerved alſo that in the proceſs for this acid, a ſmall quantity of vinegar is found in the receiver. He could not obtain the acid of ſugar from the ſaponaceous extract of urine; but got inſtead of it a ſalt, which, when completely purified, reſembled exactly the flowers of benzoin. The ſame ſalt is precipitated in abundance by adding to the extract of urine a little vitriolic or marine acid; and Mr Scheele had already remarked that the ſame ſalt is obtained in the diſtillation of ſugar of milk.

1514 Of the nature of this acid.

From the various experiments which have been made on this acid, it ſeems, according to Mr Keir, to be in an intermediate ſtate betwixt acid of tartar and acid of ſugar. This, however, ought not to prevent it from being accounted a ſeparate and diſtinct acid, otherwiſe we might confound all the vegetable acids with one another. It approaches more nearly to the nature of acid of milk than of any other. From this alſo, however, it is diſtinguiſhed, becauſe the ſalt formed by the union of acid of milk with lime is ſoluble in ſpirit of wine, but not that from lime and the acid of apples. According to Mr Hermbſtadt, if three parts of ſmoking nitrous acid be abſtracted from one part of ſugar, and if the brown acid maſs which remains in the retort be diluted with ſix times its weight of diſtilled water, and ſaturated with chalk, two compounds will be formed; one conſiſting of the acids of tartar and lime, which will precipitate; and the other of lime and the acid of apples, which will remain ſuſpended. If the calcareous earth be precipitated from this latter ſolution by adding acid of ſugar, a pure acid of apples will be left in the liquor:

and he further informs us, that this acid of apples may be changed entirely into thoſe of ſugar and vinegar, by means of ſtrong nitrous acid.

XIII. *Acetous Acid.*

1515 How to cryſtallize ſpiritus Mindereri.

It is generally believed, that the combination of this acid with volatile alkali is altogether incapable of cryſtallization; but Scheele and Morveau inform us, that it may be reduced into ſmall needle-ſhaped cryſtals, when the ſpiritus Mindereri is evaporated to the conſiſtence of a ſyrup, and left expoſed to the cold. The ſalt has a very ſharp and burning taſte, but a conſiderable quantity is loſt during the evaporation. Weſtendorf, by adding his concentrated vinegar to volatile alkali, obtained a tranſparent liquor which did not cryſtallize. By diſtillation it went over intirely into the receiver, leaving a white ſpot on the retort. A ſaline tranſparent maſs, however, appeared in the receiver under the clear fluid. On ſeparating it from the liquid, and expoſing it to a gentle heat, it melted, threw out white vapours, and in a few minutes ſhot into ſharp cryſtals reſembling nitre. Theſe remained unchanged in the cold; but when melted with a gentle warmth, ſmoked and evaporated. Their taſte was firſt ſharp and then ſweet.

1516 Salt from the acetous acid combined with calcareous earth.

The ſalt formed by uniting acetous acid with calcareous earth has a ſharp bitter taſte, and ſhoots into cryſtals ſomewhat reſembling ears of corn. Theſe do not deliquate in the air, unleſs the acid has been ſuperabundant. They are decompoſed by diſtillation *per ſe*, the acid coming over in white inflammable vapours ſmelling like acetous ether, ſomewhat empyreumatic, and condenſing into a reddiſh brown liquor. By rectification this liquor becomes very volatile and inflammable; on adding water, it acquires a milky appearance, and drops of oil ſeem to ſwim upon the ſurface; a reddiſh brown liquor, with a thick black oil, remain after rectification in the retort. On mixing this calcareous ſalt with that of Glauber, a double decompoſition takes place; we have a gypſum and the mineral alkali combined with acetous acid. By calcination, the mineral alkali may be obtained from this ſalt in a ſtate of purity. This acetous calcareous ſalt is not ſoluble in ſpirit of wine.

1517 With magneſia.

On ſaturating this acid with magneſia, and evaporating the liquor, we obtain a viſcid ſaline maſs like mucilage of gum arabic, which does not ſhoot into cryſtals, but deliqueſces in the air. It has a ſweetiſh taſte at firſt, but is afterwards bitter. It is ſoluble in ſpirit of wine, and parts with its acid by diſtillation without addition.

1518 With zinc.

Acetous acid diſſolves zinc both in its metallic and calciform ſtate, and even when mixed with other metals. By concentrated vinegar the zinc is diſſolved with great heat, ſulphureous ſmell, and exhalation of inflammable matter. By this union we obtain a congealed maſs, which on dilution with water ſhoots into oblong ſharp cryſtals at the firſt cryſtallization, and afterwards into cryſtals of a ſtellated form. From this liquor indeed cryſtals of various forms have been obtained by different chemiſts. Monnet obtained from it a pearl-coloured ſalt in friable talky cryſtals; which when thrown on the coals, fulminated a little at firſt, and gave a bluiſh flame, and then melted, letting its acid eſcape, while a yellow calx remained. Hellot informs us, that this ſalt by diſtillation *per ſe* in water, affords an inflammable liquor, and an oil at firſt yellow and then green, with white flowers burning with a blue flame. Weſtendorf obtained no oil in this diſtillation, but ſome acetous acid; a ſweet-taſted empyreumatic liquor impregnated with zinc; ſweet flowers, or ſublimate, ſoluble in water, and burning with a green flame. On applying a ſtronger heat, the zinc was ſublimed in its metallic form, leaving a ſpongy coal at the bottom of the retort. The ſolution gives a green colour to ſyrup of violets, lets fall a white precipitate on the addition of alkalies or an infuſion of galls. It is not precipitated by common ſalt, vitriolated tartar, vitriolic or marine acids, blue vitriol, or corroſive ſublimate; but forms a red precipitate when added to a ſolution of gold; a white precipitate with ſolution of ſilver; a cryſtalline pearly precipitate with ſolution of mercury; and cryſtalline precipitates with ſolutions of biſmuth and tin. According to Bergman, it is decompoſed by acid of arſenic.

1519 Its phenomena with arſenic.

Though regulus of arſenic is not ſoluble in this acid, its calx may be diſſolved either in common or diſtilled vinegar. M. Cadet obtained a ſmoking liquor by diſtillation from a mixture of white arſenic and terra foliata tartari. This experiment has been repeated by the chemiſts of Dijon, and attended with the following curious circumſtances. "We digeſted (ſay they), in a ſand-bath, five ounces of diſtilled vinegar on white pulverized arſenic; the filtrated liquor was covered, during evaporation, with a white ſaline cruſt. Of this ſubſtance were formed 150 grains; on which fixed alkali appeared to have no effect, and which was at firſt conſidered as pure arſenic. However, a cat, which had ſwallowed 72 grains of it, was only affected with vomitings that day and the next, and afterwards perfectly recovered. A ſimilar doſe was given to a little dog; but as he ran away, the effect it had upon him could not be diſcovered; but he returned afterwards in good health, and never ſhowed any uneaſineſs: whence it may be concluded, that vinegar is in ſome meaſure an antidote againſt the pernicious qualities of arſenic.

1520 Vinegar ſuppoſed to be an antidote againſt arſenic.

"On rediſſolving this ſaline cruſt in pure water, filtering and mixing it with liquid alkali, an irregularly cryſtallized ſalt was formed in it after a few days ſtanding. By this ſalt a yellow precipitate was thrown down from the nitrous ſolution of ſilver; whereas the ſolution of arſenic and terra foliata tartari threw down a white one.

"Equal parts of terra foliata tartari and arſenic, diſtilled in a retort, gave firſt a ſmall quantity of limpid liquor with a penetrating ſmell of garlic, and which had the property of reddening ſyrup of violets; while ſolution of arſenic in water turns that ſyrup green. The vinegar which now aroſe was not ſaturated when arſenic, but efferveſced ſtrongly with fixed alkali, with which it became turbid, but did not let fall any precipitate. On changing the receiver, there came over a reddiſh brown liquor, accompanied with thick vapours, diffuſing an intolerable ſmell, in which that of arſenic could ſcarcely be diſtinguiſhed. On continuing the operation, a black powder ſublimed into the neck of the retort, together with a little arſenic in its metallic form, and a matter which took fire by a lighted candle like ſulphur.

"The red liquor ſtill preſerved its property of ſmoking though cold; diffuſing at the ſame time its peculiar and abominable fetor, from which the apartment could ſcarcely be freed in ſeveral days. This liquor does not alter the colour of ſyrup of violets, but efferveſces ſlightly with fixed alkali, letting fall at the ſame time a yellow precipitate, which, however, diſappeared on an attempt to ſeparate it by filtration.

1521 Curious phoſphoric liquor.

"M. Cadet had obſerved, that the ſmoking liquor of arſenic did not kindle at the approach of a lighted candle; but that, on pouring it from the receiver into another veſſel, it had kindled the fat lute with which the junctures had been cloſed, and which had been dried during the operation: but we, being deſirous of examining more fully the nature of the red liquor which collects at the bottom, and has the appearance of oil, having decanted that which ſwims on the top, and poured the remainder on a filter of paper, before many drops had paſſed, there aroſe a thick ſmoke forming a column from the veſſel to the ceiling; a ſlight ebullition was perceived at the ſides of the veſſel, and a beautiful roſe-coloured flame appeared for a few moments. The paper filter was burnt at one ſide, but moſt of it was only blackened. After the flame was extinguiſhed, a fat reddiſh matter remained: which being melted on burning coals, ſwelled conſiderably, emitting a white flame. It then ſunk, and left on the coal a black ſpot, which could not be effaced but by the moſt vehement fire.

"At the time theſe obſervations were made, the liquor had been diſtilled for three weeks, and the bottle frequently opened. The inflammability could not proceed from the concentration of the vinegar: for the roſe-colour of the flame, the precipitation of the ſublimate, and the fixity of the ſpot remaining on the coal, evidently ſhowed that the two ſubſtances were in a ſtate of combination; which is alſo further evinced by the loſs of the inflammable property when the liquor was decompoſed by fixed alkali.—The ſmell of the liquor, however, though ſo intolerably fetid, was attended with no other inconvenience than a diſagreeable ſenſation in the throat, which further ſtrengthens the ſuſpicion that vinegar is an antidote againſt arſenic.

"The ſaline brown maſs remaining in the retort was partly diſſolved by hot water; and the filtrated lixivium was very limpid, but emitted the peculiar ſmell of the phoſphoric liquor. By evaporation it yielded a ſalt which did not deliqueſce in the air, of an irregular ſhape; and which being put on burning coals, did not ſmell ſenſibly of arſenic; loſt its water of cryſtallization; and became mealy and white without being diſſipated by heat. On expoſing the reſiduum to the air, it was found next day reſolved into a liquor; whence it is probable that moſt of it was compoſed of cryſtallized alkali, having received from the decompoſition of the vinegar as much fixed air as was neceſſary for its cryſtallization."

1522 Effect of the acetous acid on mercury.

This acid does not act upon mercury in its metallic ſtate, but diſſolves the mercurial calces, as red precipitate, turbith mineral, and the precipitate formed by adding fixed alkali to a ſolution of mercury in nitrous acid; with all which it forms white, ſhining, ſcaly cryſtals, like thoſe of ſedative ſalt.

1523 On ſilver.

Vinegar does not act upon ſilver in its metallic ſtate, but readily diſſolves the yellow calces precipitated from its ſolution in nitrous acid by microcoſmic ſalt and volatile alkali. By the help of a boiling heat alſo it very copiouſly diſſolves the precipitate obtained by means of a fixed alkali. The laſt mentioned ſolution yields ſhining, oblong, needle-ſhaped, cryſtals, which are changed to a calx by means of ſeveral acids, eſpecially the muriatic. The ſilver is thrown down in its metalic form by zinc, iron, tin, copper, and quickſilver.

1524 On gold.

Though the acetous acid has no effect upon gold in its metallic ſtate, yet a ſolution of this metal is decompoſed by crude vinegar, which produces both a metallic precipitate and dark violet-coloured powder. Diſtilled vinegar throws down the gold in its metallic form. The precipitate by fixed alkali digeſted with acetous acid is of a purple colour. This, as well as fulminating gold, is diſſolved by Weſtendorff's concentrated vinegar; the fulminating gold very eaſily. The ſolution is of a yellow colour; and with volatile alkali affords a yellow precipitate; with lixivium ſanguinis, a blue one; both of which fulminate. The dry ſalt of gold diſſolves in the acetous acid, and produces oblong yellow cryſtals.

1525 On inflammable ſubſtances.

This acid has no effect on fat oils, farther than that when diſtilled together, ſome mixture takes place, as the Abbé Rozier has obſerved. Neither does diſtilled vinegar act upon eſſential oils, though M. Weſtendorff's diſtilled vinegar diſſolved about a ſixth part of oil of roſemary, and about half its weight of camphor. The latter ſolution was inflammable, and let fall the camphor on the addition of water. The acid diſſolves all the true gums, and ſome of thoſe called gum-reſins, after being long digeſted with them. By long boiling, Boerhaave obſerves, that it diſſolves the bones, cartilages, fleſh, and ligaments of animals.

1526 Concentration of the acetous acid.

The concentration of this acid may be effected by combining it with alkalies, earths, and metals. By combining it with copper, and then cryſtallizing and diſtilling the compound, we obtain the acid in the higheſt ſtate of concentration in which it is uſually met with. To produce this ſtrong acid, we have only to diſtill verdegris, or rather its cryſtals in a retort. The operation muſt be begun by a very gentle fire, which brings over an aqueous liquor. This is to be ſet aſide, in order to procure the more concentrated acid, which comes over with a ſtronger fire. On changing the receiver, and augmenting the heat, we obtain a very ſtrong acid which comes over partly in drops, and partly in white vapours. It is called radical vinegar, or ſometimes ſpirit of Venus, and has a very pungent ſmell, almoſt as ſuffocating as that of volatile ſulphureous acid. As the laſt portions of it adhere pretty ſtrongly to the metal, we are obliged to raiſe the heat to ſuch a degree as to make the retort quite red in order perfectly to ſeparate them. Hence ſome part of the metal is raiſed along with the acid, which, diſſolving in the receiver, gives the liquor a greeniſh colour; but from this it may be eaſily freed by a ſecond diſtillation, when it riſes with a very gentle heat, and becomes extremely white. Cryſtals of verdegris afford about one half their weight of radical vinegar; but verdegris itſelf much leſs, and of a more oily quality.

1527 Of its cryſtallization.

If this acid be heated in a wide-mouthed pan, and fire applied to it, it will burn entirely away like ſpirit of wine. This obſervation we owe to the count de Lauragais, who has likewiſe obſerved, that it is capable of cryſtallization. This, however, takes place only with the laſt portions which came over, and the cryſtals appear in the form of plates or needles. The marquis de Courtrivon, who has repeated and confirmed the experiment of the count de Lauragais, ſuppoſes this phenomenon to be owing to a ſulphur-like mixture of acetous acid and phlogiſton. Leonhardi ſuppoſes an analogy between theſe cryſtals and the white ſalt of copper expelled at the end of the operation by the count de Laſſone. This ſalt was at firſt very white, and fixed on the neck of the retort pretty thick; but unleſs quickly collected, was ſoon deſtroyed by the ſucceeding vapours. When expoſed to the air, it attracts moiſture, and runs into a greeniſh liquid. It is uncommonly light, and in ſuch ſmall quantity, that ſcarce five or ſix grains can be collected from a pound of verdegris. Its taſte is acid, auſtere, very unpleaſant and permanent. It readily and totally diſſolves in water, and partially in ſpirit of wine, leaving a yellow powder totally ſoluble in volatile alkali, and which burns with a green flame. From this ſalt, volatile alkali acquires a blue colour, and litmus a red one; and thus it diſcovers itſelf to be compoſed of acetous acid and copper.

1528 Difference between radical vinegar and common acetous acid.

Experience has ſhown that radical vinegar differs conſiderably in its properties from the common acid. It has a greater attraction for alkalies, forms with them more perfect combinations, and is leſs volatile. M. Berthollet obſerves, that when vinegar concentrated by froſt and radical vinegar, are reduced to equal denſities, by adding water to the heavier of the two, they differ very much both in ſmell and taſte. Laſſone found, that radical vinegar formed a cryſtallizable compound with volatile alkali; and Berthollet has obſerved the ſame with regard to fixed vegetable alkali. The cryſtals of the latter with radical vinegar were flat, tranſparent, and flexible, ſlowly deliqueſcent in the air. On comparing the ſalts formed by the two acids, he found, that the acetous ſalt rendered the ſyrup of violets green; but its colour remained unaltered with that made with radical vinegar. The latter alſo required a ſtronger fire to expel part of its acid; it was alſo whiter, and had a leſs acid taſte. On pouring radical vinegar on the acetous ſalt, the ſolution afforded, by evaporation and cryſtallization, a ſalt perfectly ſimilar to that procured directly from radical vinegar and fixed alkali. On diſtilling the mixture, the radical vinegar appeared to have expelled the common acetous acid, as the liquor which came over effervesced with vegetable alkali, and formed with it a terra foliata tartari.

“It ſeems probable (ſays Mr Keir), that the radical vinegar contains a larger portion of the aerial principle than the common acetous acid; by which it undergoes a change ſimilar to that of marine acid, when brought into that ſtate in which it is ſaid to be dephlogiſticated. This air it may acquire from the metallic calx, which being deprived of its air is reduced to its metallic ſtate. Thoſe who believe in the phlogiſton of metals, may ſay that the acid is dephlogiſticated by imparting its phlogiſton to the metal, which is thereby metallized. It appears, however, to be very diſtinct from common acetous acid, and deſerves to have its properties and compounds farther inveſtigated.”

1529 How to obtain it pure from terra foliata tartari.

Concentrated acetous acid, of a great degree of ſtrength may alſo be obtained by diſtilling terra foliata tartari with vitriolic acid; but Leonhardi obſerves, that the acid thus obtained is always more or leſs contaminated with the volatile acid of ſulphur. He obſerves alſo, that the method propoſed of ſeparating the ſulphureous acid by a ſecond diſtillation from ſalt of tartar is not effectual, becauſe the ſulphureous acid has leſs attraction for alkalies than the acetous. Weſtendorf recommends the neutral ſalt formed by acetous acid and mineral alkali, inſtead of the terra foliata tartari. Thus, in the firſt place, we readily obtain cryſtals free from the inflammable matter of the vinegar; and, in conſequence of this, though we diſtil it afterwards with concentrated oil of vitriol, no ſulphureous taint can be produced. Even ſuppoſing this to be the caſe (he ſays), it may be removed by a ſecond diſtillation from ſome mineral alkali. Mr Keir, however, obſerves, that “probably all the acids diſtilled from acetous ſalts by means of the vitriolic, partake of the property of that procured by diſtilling cryſtals of verdegris; and none of them can compare with that from which Mr Louitz obtained acetous ether without addition, as a pure concentrated and unaltered vinegar.”

XIV. *Acid of Benzoin.*

1530 M. Lichtenſtein's account of its properties.

THE properties of this acid have been inveſtigated by M. Lichtenſtein, and are as follow. 1. Expoſed to the heat of a candle in a ſilver ſpoon, it melts as clear as water, without burning, though it is deſtroyed by contact of flame. 2. When thrown upon coals, it evaporates, without reſiduum, in a thick white ſmoke. 3. It is not volatile without a conſiderable degree of heat. 4. By very ſlow cooling its aqueous ſolution yields large cryſtals, long, thin, and of a feathery ſhape. 5. It is ſoluble in the concentrated acids of nitre and vitriol, but ſeparates from them, without decompoſition, on the addition of water. 6. By the other acids it cannot be diſſolved without heat, and ſeparates from them alſo without any change, merely by cooling. 7. It is copiouſly diſſolved by ſpirit of wine, and precipitated from it on the addition of water. 8. With alkalies it forms neutral ſalts, very ſoluble in water, and of a ſharp ſaline taſte. With vegetable alkali it forms cryſtals of a pointed feathery form: with mineral alkali it yields larger cryſtals, which fall into powder on being expoſed to the air; and with volatile alkali it is difficultly cryſtallizable into ſmall, feathery, and deliqueſcent cryſtals. It is ſeparable from alkalies by the mineral acids. 9. With calcareous earth it forms white, ſhining, and pointed cryſtals, not eaſily ſoluble, and which have a ſweetiſh taſte without any pungency. 10. With magneſia ſmall feathery cryſtals are formed, of a ſharp ſaline taſte, and eaſily ſoluble in water. 11. An aſtringent ſalt is formed with earth of alum.

All theſe earthy ſalts are eaſily decompoſed by the mineral acids as well as by alkalies. The acid of benzoin itſelf reddens litmus, but has little effect upon ſyrup of violets.

1531
Effects of nitrous acid upon it.

Meſſrs. Hermbſtadt and Lichtenſtein have both tried the effects of nitrous acid upon that of benzoin. In this operation, however, a great obſtacle aroſe from the volatility of the acid of benzoin, which prevented it from bearing any conſiderable heat without paſſing over into the receiver. By repeated diſtillations, however, the acid of benzoin, diminiſhed in its volatility, aſſumed a darker colour, and acquired a bitteriſh taſte. A coal was alſo left at the bottom; and, at the end of the third operation, when the nitrous acid had been all drawn off, M. Hermbſtadt obſerved that ſome brown drops came over which had the appearance of a dark-coloured tranſparent oil, ſoluble in diſtilled water, emitting acrid fumes, and having a very cauſtic taſte. On diſtilling this acid liquor a ſecond time, a yellow ſaline maſs was obtained, which, when diſſolved in diſtilled water, formed a fluid acid, which precipitated a ſolution of ſugar of lead and lime-water. On examining the charred reſiduum left in the retort, he obſerved, that, after calcination, ſome of the earth had been vitrified, while another was of a ſoft conſiſtence, and had acquired a cauſtic taſte. From a mixture of the abovementioned dark-brown acid and ſpirit of wine, he obtained an ether, which differed from the nitrous in being much leſs volatile, and ſmelling like bitter almonds.

From this reſiduum Mr Lichtenſtein obtained a reſinous ſubſtance, to which he aſcribes the volatility of the acid of benzoin, as well as the ſmell of bitter almonds already mentioned.

Scheele failed in his attempt to obtain ether from flowers of benzoin and ſpirit of wine; but, by adding a little ſpirit of ſalt, he obtained a kind of ether which fell to the bottom. On diſſolving this in alkalized ſpirit of wine, and drawing off the latter by diſtillation, he obtained from it a quantity of flowers of benzoin. From Peruvian balſam alſo Lehman obtained a quantity of the acid of benzoin. It may alſo be procured from urine, either by precipitation, from the ſaponaceous extract (A), or by repeatedly diſtilling from it ſpirit of nitre, as in the preparation of acid of ſugar. In the urine it is found combined with votatile alkali, by which it becomes ſoluble in ſpirit of wine.

1532
Acid of benzoin procurable from Peruvian balſam and urine.

XV. *Sebaceous Acid.*

This is ſaid to have been firſt diſcovered by Mr Gruitzmacker, who publiſhed an account of it in 1748. It was afterwards more accurately treated of by Mr Rhades in 1753. Its properties were inveſtigated by Meſſrs Segner and Knappe in 1754; and afterwards more fully by Dr Crell, of whoſe diſcoveries an account is given in the Philoſophical Tranſactions for 1780 and 1782. It is found not only in the fat of all animals, but in ſpermaceti, the butter of cocoa, and probably in other vegetable oils. In ſeveral reſpects it ſeems analogous to the marine acid; but in others it is remarkably different, particularly in precipitating a ſolution of corroſive ſublimate. It is probable, however, that is principles are the ſame with thoſe contained in all other vegetable and animal acids; and this opinion is ſupported by what happens on treating tallow in the uſual manner for obtaining acid of ſugar; for thus, not the ſebaceous, but the ſaccharine acid is found to be produced. It has a very great ſtrength of attraction, and by means of heat decompounds even the vitriolic ſalts themſelves; but in the moiſt way is expelled by the three mineral acids, though it expels all the vegetable ones, as well as thoſe of fluor and arſenic. Its moſt remarkable property is its effect on tin. The filings of this metal, eſpecially with the aſſiſtance of heat, are corroded by it into a yellow powder, and at the ſame time give out a very fetid ſmell. The ſolution, though filtered, ſtill continues turbid, and depoſits more yellow powder, acquiring at the ſame time a fine roſe-red colour. By adding water to this yellow powder, a white deliqueſcent ſalt may be obtained, and a ſimilar one obtained by diſſolving a yellow powder precipitated by this acid from ſolution of tin in aqua-regia.

1533
Sebaceous acid procurable from various ſubſtances.

1534
Has a remarkable power of attraction.

1535
Remarkable effect on tin.

1536
Its effects on other ſubſtances.

It corrodes lead rather than diſſolves it; but diſſolves a conſiderable quantity of minium, and changes the reſt to a white powder. This ſolution is ſweetiſh, and is not precipitated by common ſalt. The metal is precipitated by ſebaceous acid from the nitrous, in white needle-like cryſtals, eaſily ſoluble in water. A like precipitation takes place in ſolution of ſugar of lead; but the precipitate is ſtill ſoluble in ſtrong vinegar, provided it be not adulterated with oil of vitriol. In its elective attractions it agrees with the acids of apples and of fluor, preferring magneſia to fixed alkali.

XVI. *Acid of galls.*

Though it has for a long time been known that the infuſion of galls has the property of reddening vegetable juices, diſſolving iron, and decompoſing liver of ſulphur, theſe effects were generally aſcribed to its aſtringency. Of late, however, it has been found, that beſides this aſtringent principle a true acid exiſts in galls; and to this, rather than to the aſtringent principle, are we to aſcribe the properties of galls in ſtriking a black with ſolution of vitriol, &c.

1537
Method of ſeparating the acid.

To ſeparate the acid from the other matters contained in the galls, we muſt add fixed alkali to a decoction of them; by which means the aſtringent matter will be thrown down, and the acid remain in the liquor joined to the alkali, the precipitate, waſhed with clean water, dried, and rediſſolved, blackened a ſolution of vitriol but faintly, and no more than what may be ſuppoſed to proceed from ſome remaining acid, which could not be abſtracted. This is proved by diſtilling

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(A) By this is meant urine evaporated to a thick conſiſtence, and deprived of moſt of its ſalts by ſolution in ſpirit of wine.

Acid of galls. ſtilling the aſtringent matter in queſtion, when an acid liquor comes over, which has the property of blackening ſolution of vitriol. 1538 An acid obtained from galls by diſtillation. Scheele has obſerved, that when galls in ſubſtance are expoſed to diſtillation, an acid liquor riſes of an agreeable ſmell, without oil, and afterwards a kind of volatile ſalt, which is the true acid of the galls. Hence he infers, that this ſalt is contained ready formed in the galls themſelves; but ſo much involved in ſome gummy or other matter, that it cannot be eaſily obtained ſeparately.

The acid of galls is capable of being ſeparated by cryſtallization. In an infuſion made with cold water, Scheele obſerved a ſediment which appeared to have a cryſtalline form, and which was acid to the taſte, and had the property of blackening ſolution of vitriol. By expoſing the infuſion for a long time to the air, and removing from time to time the mouldy ſkin which grew upon it, a large quantity of ſediment was formed. On rediſſolving this in warm water, filtering and evaporating it very ſlowly, an acid ſalt was obtained in ſmall cryſtals like ſand, which had the following 1539 Properties of this acid properties: 1. It taſted acid, effervesced with chalk, and reddened litmus. 2. Three parts of boiling water diſſolved two of the ſalt; but 24 parts of cold water were required to diſſolve one. 3. It is likewiſe ſoluble in ſpirit of wine; four parts of which are required to diſſolve one of the ſalt when cold, but only an equal quantity when aſſiſted by a boiling heat. 4. The ſalt is deſtructible by an open fire, melts and burns with a pleaſant ſmell, leaving behind a hard inſoluble coal, which does not eaſily burn to aſhes. 5. By diſtillation an acid water is firſt obtained without any oil: then a ſublimate, which remains fluid while the neck of the retort is hot, and then cryſtallizes. This ſublimate has the taſte and ſmell of flowers of benzoin; is ſoluble in water and in ſpirit of wine; reddens litmus; and precipitates metallic ſolutions of the following colours, viz. gold of a dark brown; ſilver of a grey colour; copper of a brown; iron of a black; lead of a white colour; mercury of an orange; biſmuth, lemon-coloured. The acid of molybdæna became yellow coloured, but no precipitate enſued. Solutions of various kinds of earths were not altered; but lime-water afforded a copious grey-coloured precipitate. 6. By treating this acid with that of nitre, in the manner directed for producing acid of ſugar, it was changed into the latter.

XVII. *Identity of the Vegetable Acids.*

On the proofs of the identity of the vegetable acids with one another, Mr Keir makes the following re-
1540 Mr Keir's objections to the opinions on this ſubject. mark: "The experiments and obſervations which have been made, prove evidently a ſtrong analogy between the acetous acid, ſpirit of wine, tartar, and acid of ſugar; and they ſeem to ſhow the exiſtence of a common principle or baſis in all of them, modified either by the addition of another principle not common to all of them, or by different proportions of the ſame principle. None of the opinions on this ſubject, however, are quite ſatisfactory. The production of the acetous acid by treating ſpirit of wine with other acids, does not prove that the acetous acid was contained in the ſpirit of wine, but only in concurrence with them, that they contain ſome common principle. Indentity of the vegetable acids. There is no fact adduced to ſupport Morveau's opinion, that fixed air is abſorbed during the acetous fermentation; or that the preſence of this fixed air is neceſſary. The decompoſition of all vegetable acids by heat, and the production therefrom of fixed and inflammable gaſes, ſhow that theſe acids contain ſome of the ſame principles as theſe elaſtic fluids, but do not prove that the gaſes exiſted in the fluids. We have good reaſon to believe that acetous acid does not contain any fixed air already formed; for it yields none when vitriolic acid is added to it, or to foliated earth; nevertheleſs, my opinion that vegetable and animal acids are, by heat, in a great meaſure convertible into fixed air, ſeems to be ſufficiently proved by experiments. 1542 Quantities of the different ſubſtance obtained from foliated earth. Thus Hales has ſhown the great quantities of this gas which tartar yields on diſtillation. Berthollet has obtained the fixed and inflammable gaſes from foliated earth; and Dr Higgins has verified this experiment, and deduced the quantities. From 7680 grains of foliated earth, the Doctor obtained.

Cauſtic alkali	-	3862.994 grains.
Fixed air	-	1473.564
Inflammable air	-	1047.6018
Oily matter retained in the reſiduum	- -	78
Oil	- - -	182
Water condenſed	-	340
Deficiency attributed chiefly to water	- -	726.9402"

As fixed and inflammable gaſes may be obtained from every vegetable ſubſtance by fire, nothing can be inferred from theſe experiments to explain particularly the nature of the acetous acid, excepting that it contains ſome of the inflammable matter common to the vegetable kingdom, and eſpecially of the matter common to vegetable acids; all which alſo, when analyſed, furniſh large quantities of theſe two gaſes.

"Although we are far (adds our author) from the knowledge requiſite to give a complete theory of the acetous fermentation, yet it may be uſeful to explain the ideas that appear moſt probable. In all the inſtances that we know of the formation of acids, whether effected by combuſtion, as the acids of ſulphur and phoſphorus, or by repeated abſtractions of nitrous acid, as in the proceſs for making acid of ſugar, a very ſen-
1543 Air abſorbed in the formation of all acids. ſible quantity of pure air is abſorbed. In the caſe of combuſtion we know, from the weight acquired, that there is a great abſorption of air; and in the latter caſe, of acids being produced by application of nitrous acid, as this acid conſiſts of nitrous and pure air, and as in theſe operations a quantity of the nitrous gas is expelled, there ſeems but little doubt that there alſo the pure air of the nitrous acid is united with the ſubſtance employed in the formation of the new acid. Hence, from all that we know, the abſorption of air takes place in all acidifying proceſſes. But it alſo actually takes place in the acetous fermentation, as has been obſerved, particularly by the Abbe Rozier; and it is generally known, that air is neceſſary to the formation of vinegar. The next queſtion is, What is the baſis? And from the experiments already related, of forming the acetous acid by means of ſpirit of wine, it ſeems probable, either that this ſpirit is the baſis of the acetous acid, or that it contains this baſis: and from the convertibility of the acids of tartar and of

ſugar

Identity of the vegetable acids.

ſugar into the acetous acid by the proceſſes above deſcribed, it ſeems probable that theſe alſo contain the ſame common baſis; which, being united with a determined quantity of pure air, forms acid of tartar; with a larger quantity, acid of ſugar; and with a ſtill larger, the acetous acid.

1544 Inflammable ſpirit produced from radical vinegar.

“An inflammable ſpirit is ſaid to appear at the end of the diſtillation of radical vinegar from verdigris. Now, if the ardent ſpirit were contained in the verdigris, as it is more volatile than the acid, it ought to come over firſt; but as it appears only towards the end of the diſtillation, it ſeems to be formed during the operation; and I imagine, that the metal, when almoſt deprived of its acid, attracts ſome of the air of the remaining acid; and the part or baſis of the acid thus deprived of its air becomes then an inflammable ſpirit, and in ſome caſes an oil appears. But as the quantity of acid thus decompoſed is very ſmall, and little air of conſequence remains united with the metallic part of the verdigris, the copper appears rather in a metallic than calciform ſtate after the operation. But zinc, during its ſolution in concentrated vinegar, decompoſes the acid as it does the vitriolic and other ſtrong acids, and accordingly inflammable vapours are produced; and what is remarkable, theſe vapours have a ſulphureous ſmell. Iron always, during its ſolution in concentrated vinegar, produces an expulſion of inflammable vapours; which, however, do not explode like inflammable gas.

1545 Sulphureous inflammable vapours produced from it.

1546 Of the conſtituent parts of the acetous acid.

“We muſt not imagine that we are yet able to explain completely what paſſes in the acetous fermentation, or that the acetous acid is a compound of mere ſpirit and pure air. Beſides this combination of ſpirit and air, it is obſerved, that a precipitation always takes place before the fermentation is completed, of ſome mucilaginous matter, which diſpoſes the vinegar to putrefy, and from which it therefore ought to be carefully ſeparated. Stahl affirms, that without a depoſition of ſuch ſediment, vinegar cannot be made from ſugar, wine, or other juice. Beſides the matter that is depoſited, probably as much remains in the liquor as can be diſſolved therein; for, by diſtillation, much of a ſimilar extractive matter is left in the retort. What the nature of this matter is, and how it is formed, has not yet been examined. Though diſtillation frees the acid from much of this extractive ſubſtance, yet we have no reaſon to believe that we have ever obtained it entirely free from inflammable matter; as it retains it even when combined with alkalies and with metals. When ſugar of lead and other acetous ſalts are diſtilled with a ſtrong heat, the ſubſtances remaining in the retort have been obſerved to poſſeſs the properties of a pyrophorus; and this will happen whatever pains have been taken to purify the vinegar employed. See the article PYROPHORUS. This fact ſhows the exiſtence of an inflammable matter in this acid; and which may perhaps be eſſential in its compoſition, and neceſſary to its properties. Although fermentation is the uſual mode of obtaining acetous acid, yet it appears from the inſtances obſerved by latter chemiſts, that it is not eſſential to its formation, but that it is alſo formed in various chemical proceſſes; and the acid obtained by diſtillation from woods, wax, &c. are very analogous to vinegar. It appears alſo on treating the acid of ſugar with nitrous acid, as has been obſerved both by Weſtrumb and Scheele. The latter further acquaints us, that he obtained it in analyſing a tallow like oil, which remained undiſſolved upon digeſting ſtarch in nitrous acid. As acid of ſugar alſo may be obtained from a variety of animal ſubſtances, and as this acid is convertible into the acetous we have one reaſon more added to many others, to prove that the matters of vegetable and animal ſubſtances are not capable of any chemical diſtinction.”

1547 It is formed in various chemical proceſſes.

Addition to Sect. I. § 20.

XVIII. ADDITION to Sect. I. § 20. *concerning the volatility of a Mixture of* MARINE *and* NITROUS ACIDS.

1548 How to deprive aqua-regia of its volatility.

THIS is much leſs ſenſible when the acids are weak than when they are concentrated. On mixing the two when moderately ſmoking, and which had remained for a long time ſeparate without occaſioning any diſturbance, a vaſtly ſmoking aqua-regia has been produced, which would either drive out the ſtopple, or burſt the bottle in warm weather. On diſtilling a pretty ſtrong nitrous acid from ſal ammoniac, M. Beaumé obſerved, that the vapours which came over were ſo exceedingly elaſtic, that notwithſtanding every precaution which could be taken in ſuch a caſe, the diſtillation could not be continued. By letting this eſcape, however, Mr Cornette obſerved, that the diſtillation of theſe two ſubſtances may be carried on to the end without any inconvenience, and the aqua-regia will then be no longer troubleſome.

XIX. *TEST for* ACIDS *and* ALKALIES.

THE general method recommended for diſcovering a ſmall quantity of acid or alkali in any liquid, is by trying it with any vegetable blue, ſuch as ſyrup of violets; when, if the acid prevails in the liquor, the ſyrup will acquire a red colour, more or leſs deep according to the quantity of acid; or if the alkali prevail, it will change the ſyrup green in like proportion. Since the late improvements in chemiſtry, however, the ſyrup has been found deficient in accuracy, and the infuſion of turneſole, or of an artificial preparation called litmus, have been ſubſtituted inſtead of it. The infuſion of litmus is blue, and, like ſyrup of violets, becomes red with acids. It is ſo ſenſible that it will diſcover one grain of oil of vitriol though mixed with 100,000 of water. Unfortunately, however, this infuſion does not change its colour on mixture with alkalies; it is therefore neceſſary to mix it with juſt as much vinegar as will turn the infuſion red, which will then be reſtored to its blue colour by being mixed with any alkaline liquor. The blue infuſion of litmus is alſo a teſt of the preſence of fixed air in water, with which it turns red, as it does with other acids.

1549 Inaccuracy of the common teſts.

The great ſenſibility of this teſt would leave very little reaſon to ſearch for any other, were it always an exact teſt of the point of ſaturation of acids and alkalies; but, from the following fact, this appears to Mr Watt to be dubious. A mixture of phlogiſticated nitrous acid with an alkali will appear to be acid by the teſt of litmus, when other teſts, ſuch as the infuſion of the petals of the ſcarlet roſe, of the blue iris, of violets, and of other flowers, will ſhow the ſame liquor to be alkaline, by turning green ſo evidently as to leave no room to doubt.

When Mr Watt made this diſcovery, the ſcarlet roſes, 1550 Red cabbage anſwers the purpoſe beſt.

ſes, and ſeveral other flowers, whoſe petals change their colour by acids and alkalies, were in flower. Having ſtained paper with their juices, he found that it was not affected by the phlogiſticated nitrous acid, excepting in ſo far as it acted the part of a neutralizing acid; but he found alſo, that, paper ſtained in this manner was much leſs eaſily effected than litmus was; and that, in a ſhort time, it loſt much of the ſenſibility which it poſſeſſed at firſt; and having occaſion in winter to repeat ſome experiments in which the phlogiſticated nitrous acid was concerned, he found his ſtained paper almoſt uſeleſs. Searching, therefore, for ſome other vegetables which might ſerve for a teſt at all ſeaſons of the year, he found the red cabbage to anſwer his purpoſe better than any other; having both more ſenſibility with regard to acids than litmus, being naturally blue, and turning green with alkalies, and red with acids; to all which is joined the advantage of its being no farther affected by the phlogiſticated acid of nitre than as it acts as a real acid.

1551 How to prepare it for uſe.

To prepare this teſt, Mr Watt recommends to take the freſheſt leaves of the cabbage; to cut out the large ſtems, and mince the thin parts of the leaves very ſmall; then to digeſt them in water at about the heat of 120 degrees for a few hours, when they will yield blue liquor; which, if uſed immediately as a teſt, will be found to poſſeſs great ſenſibility: but as in this ſtate it is very apt to turn putrid, ſome of the following methods muſt be uſed for preſerving it.

1. After having minced the leaves, ſpread them on paper, and dry them in a gentle heat; when perfectly dry, put them up in glaſs bottles well corked; and, when you want to uſe them, acidulate ſome water with vitriolic acid, and digeſt or infuſe the dry leaves in it, until they give out their colour; then ſtrain the liquor through a cloth, and add to it a quantity of fine whiting or chalk, ſtirring it frequently, until it becomes of a true blue colour, neither inclining to green nor purple; when you perceive that it has acquired this colour, filter it immediately; otherwiſe it will become greeniſh by ſtanding longer on the whiting. This liquor will depoſit a ſmall quantity of gypſum, and, by the addition of a little ſpirit of wine, will keep good for ſome days; but will then become ſomewhat putrid and reddiſh. If too much ſpirit is added, it deſtroys the colour. If the liquor is wanted to keep longer, it may be neutralized by a fixed alkali inſtead of chalk.

2. As thus the liquor cannot be long preſerved without requiring to be neutralized afreſh juſt before it is uſed; and as the putrid fermentation which it undergoes, and perhaps the alkalies or ſpirit of wine mixed with it, ſeem to leſſen its ſenſibility; in order to preſerve its virtues while kept in a liquid ſtate, ſome freſh leaves of the cabbage, minced as above directed, may be infuſed in a mixture of vitriolic acid and water, of about the degree of acidity of vinegar; and it may be neutralized, as it is wanted, either by means of chalk, or of the fixed or volatile alkali. It muſt be obſerved, however, that if the liquor has an exceſs of alkali, it will ſoon loſe its colour, and become yellow; from which ſtate it cannot be reſtored; care ſhould therefore be taken to bring it very exactly to a blue, and not to let it verge towards a green.

3. In this manner, Mr Watt prepared a red infuſion of violets; which, on being neutralized, formed a very ſenſible teſt, though he did not know how long theſe properties would be preſerved; but he is of opinion that the coloured infuſions of other vegetables may be preſerved in the ſame manner by the antiſeptic power of the vitriolic acid, in ſuch a manner as to loſe little of their original ſenſibility. Paper freſh ſtained with theſe teſts, in their neutral ſtate, has ſufficient ſenſibility for many experiments; but the alum and glue which enter into the preparation of writing paper, ſeem, in ſome degree, to fix the colour; and paper which is not ſized becomes ſomewhat tranſparent when wetted; which renders ſmall changes of colour imperceptible. Where accuracy is required, therefore, the teſt ſhould be uſed in a liquid taſte.

1552 Various other teſts.

4. Our author has found that the infuſion of red cabbage, as well as of various flowers in water, acidulated by means of vitriolic acid, are apt to turn mouldy in the ſummer ſeaſon, and likewiſe that the moulding is prevented by an addition of ſpirit of wine. He has not been able to aſcertain the quantity of ſpirit neceſſary for this purpoſe, but adds it by little and little at a time until the proceſs of moulding is ſtopped.—Very ſenſible teſts are afforded by the petals of the ſcarlet roſe, and of the pink coloured lychnis treated in the abovementioned manner.

XX. *Volatile Alkali.*

1553 Volatile alkali prepared from nitrous acid and tin.

Mr Higgins claims the firſt diſcovery of the conſtituent parts of volatile alkali, or at leaſt of an experiment leading to it. "About the latter end of March 1785 (ſays he), I found that nitrous acid poured on tin filings, and immediately mixed with fixed vegetable alkali, generated volatile alkali in great abundance: ſo ſingular a fact did not fail of deeply impreſſing my mind, though at the time I could not account for it. About a fortnight after, I mentioned the circumſtance to Dr Brockleſby. He told me he was going to meet ſome philoſophical gentlemen at Sir Joſeph Banks's, and deſired I would generate ſome alkali to exhibit before them: accordingly I did; and had the pleaſure of accompanying him thither. The December following I mentioned the fact to Dr Caulet, and likewiſe the copious generation of volatile alkali from Pruſſian blue, vegetable alkali, and water; on which we agreed to make a ſet of experiments upon the ſubject. At preſent I ſhall only give an account of the following, which drew our particular attention. Into a glaſs cylinder, made for the purpoſe, we charged three parts of alkaline air, and to this added one part of dephlogiſticated air; we paſſed the electrical ſpark repeatedly in it, without apparently effecting the ſmalleſt change. When it had received about 100 ſtrong ſhocks, a ſmall quantity of moiſture appeared on the ſides of the glaſs, and the braſs conductors ſeemed to be corroded; when we had paſſed 60 more ſhocks in it, the quantity of moiſture ſeemed to increaſe, and acquire a greeniſh colour, though at this time the column of air ſuffered no diminution. On examining the air, it burned with a languid greeniſh flame, from which we inferred that the dephlogiſticated air was totally condenſed: it ſtill retained an alkaline ſmell; and the alkaline part was not readily abſorbed by water.

1555 Effects of the electric ſpark on it.

1556 True compoſition of volatile alkali.

“ From Mr Cavendiſh's famous diſcovery of the conſtituent parts of water we could readily account for the loſs of the dephlogiſticated air in this experiment; but the quantity of water was more than we could expect from this: therefore water muſt have been precipitated from the decompoſed alkali; for volatile alkali, from its great attraction to water, muſt keep ſome in ſolution even in its aeriform ſtate. From the above circumſtances it might be expected, that a contraction of the column of air ſhould take place; but it muſt be conſidered, that the union took place gradually in proportion as the alkali was decompoſed; and that, in this caſe, the expanſion muſt equal the condenſation. During the ſpring of 1786 I had often an opportunity of mentioning different facts to Dr Auſtin relating to volatile alkali, who at that time was too much engaged to pay attention to the ſubject. In the end of Auguſt 1787, he gave me an account of a ſet of experiments which he had made, and which actually proved, that volatile alkali conſiſts of light inflammable and phlogiſticated airs; not knowing at that time what Meſſrs Houſman and Berthollet had done. Without depreciating the merit of theſe two gentlemen, Dr Auſtin has an equal claim to the diſcovery, laying aſide priority; as his experiments are as deciſive as theirs. Dr Prieſtley made the firſt ſtep towards our knowledge of volatile alkali.”

XXI. *Pruſſian Blue.*

1557 Woulfe's teſt for mineral waters.

1558 Effect of it on various metallic ſolutions.

The acid of this ſubſtance, as far as it contains an acid, is ſuppoſed to be that of phoſphorus. Mr Woulfe propoſed a teſt of this kind for diſcovering iron in mineral waters, which, he obſerved, would not be affected by acids; but the lixivium deſcribed by him had the bad property of letting fall the Pruſſian blue it contains in a few weeks. The precipitate of copper, however, treated again with alkali, retained this property upwards of nine months. The volatile alkali, he obſerves, is diſſolved by the Pruſſian acid; and the cryſtals depoſited are rendered blue by the colouring matter, though the colour at firſt is loſt by the union of the alkali with the ſubſtance already made. The metals were precipitated by this teſt of the following colours: Gold of a browniſh yellow, the precipitate afterwards becoming of a full yellow; platina of a deep blue, but when quite pure, of a yellow colour, turning ſlightly green. Silver in the nitrous acid was precipitated of a whitiſh colour; copper from all the different acids was precipitated of a deep brown colour, the liquid remaining greeniſh; green vitriol let fall a deep blue powder, leaving a colourleſs lixivium; ſugar of lead and muriated tin gave a white powder; nitrated mercury a white or yellowiſh precipitate; the Illfeld mangăneſe a browniſh, but that from Devonſhire a blue, which firſt became aſh-coloured and then reddiſh. Nitrated biſmuth afforded a white precipitate, and the lixivium was ſlightly green: muriated antimony yielded a white precipitate, with a yellowiſh lixivium: vitriolated zinc a whitiſh: cobalt in aqua-regia a reddiſh white powder: the precipitate of arſenic and the different earths was commonly white.

XXIII. *New Chemical Nomenclatures.*

1. *Of that propoſed in 1787 by Meſſrs Morveau, Berthollet, Fourcroy, and Lavoiſier.*

1559 Bergman's letter to Morveau on this ſubject.

When this nomenclature was firſt publiſhed, M. Lavoiſier informs us, that ſome blame was thrown upon the authors for changing the language, which had received the ſanction of their maſters, and been adopted by them. In anſwer to this, however, he urges, that Meſſrs Bergman and Macquer had expreſſed a wiſh for ſome reformation in the chemical language. Mr Bergman had even written to M. Morveau on the ſubject in the following terms. “ Show no favour to any improper denomination: Thoſe who are already poſſeſſed of knowledge, cannot be deprived of it by new terms; thoſe who have their knowledge to acquire, will be enabled by your improvement on the language of the ſcience to acquire it ſooner.”

1560 Lavoiſier's explanation of the new nomenclature.

The following is M. Lavoiſiers explanation of the principles on which his new language is compoſed. “ Acids conſiſt of two ſubſtances, belonging to that order which comprehends ſuch as appear to us to be ſimple ſubſtances. The one of theſe is the principle of acidity, and common to all acids; from it therefore ſhould the name of the claſs and genus be borrowed: The other, which is peculiar to each acid, and diſtinguiſhes them from one another, ſhould ſupply the ſpecific name. But in moſt of the acids, the two conſtituent principles, the acidifying and the acidifyed, may exiſt in different proportion, forming different degrees of equilibrium or ſaturation; this is obſerved of the *ſulphuric* and *ſulphureous* acid. Theſe two ſtates of the ſame acid we have expreſſed by varying the termination of the ſpecific name.

“ Metallic ſubſtances, after being expoſed to the compound action of air and fire, loſe their metallic luſtre, gain an increaſe of weight, and aſſume an earthy appearance. In this ſtate they are, like acids, compound bodies, conſiſting of one principle common to them all, and another peculiar to each of them. We have therefore in like manner claſſed them under a generic name, derived from the principle which is common to them all. The name which we have adopted is *Oxide:* The peculiar names of the metals from which they are formed, ſerve to diſtinguiſh theſe compounds from one another.

“ Combſtuible ſubſtances, which, in acids and metallic oxides, exiſt as ſpecific and peculiar principles, are capable of becoming, in their turn, the common principle of a great number of ſubſtances. Combinations of ſulphur, were long the only compounds of this ſort known: but of late the experiments of Meſſrs Vandermonde, Monge, and Berthollet, have ſhown that coal combines with iron and perhaps with various other metals; and that the reſult of its combination with iron are, according to the proportions, ſteel, plumbago, *&c.* It is alſo known from the experiments of M. Pelletier, that phoſphorus combines with many metallic ſubſtances. We have therefore arranged theſe different combinations together under generic names, formed from the name of the common ſubſtance, with a termination indicating this analogy; and have diſtinguiſhed them from each other by ſpecific names derived from the names of the peculiar ſubſtances.

New chemical nomenclatures.

" It was found ſomewhat more difficult to form a nomenclature for the compounds of thoſe three ſimple ſubſtances; becauſe they are ſo very numerous, and ſtill more, becauſe it is impoſſible to expreſs the nature of their conſtituent principles, without uſing more compound names. In bodies belonging to this claſs, ſuch as neutral ſalts for inſtance, we had to conſider, 1. the acidifying principle common to them all; 2. the acidifiable principle which peculiarizes the acid; 3. the ſaline, earthy, or metallic baſe, which determines the particular ſpecies of the ſalt. We have derived the name of each claſs of ſalts from that of the acidifiable principle, common to all the individuals of the claſs; and have then diſtinguiſhed each ſpecies by the name of the *ſaline*, *earthy*, or *metallic* baſe peculiar to it.

" As ſalt, conſiſting of any three principles, may, without loſing any of theſe principles, paſs through different ſtates by the variation of their proportions; our nomenclature would have been defective without expreſſions for theſe different ſtates. We have expreſſed them chiefly by a change of termination, making all names of ſalts in the ſame ſtate to end with the ſame termination."

2. *Nomenclature by M. Wiegleb.*

1562
Mr Wiegleb's nomenclature.

In Wiegleb's General Syſtem of Chemiſtry tranſlated by Hopſon, we have another nomenclature formed on different principles. In this he gives to fixed vegetable alkali the name of *Spodium*, from the Greek word σποδος *(aſhes)*. The mineral alkali he calls *natrum*, the name by which it was anciently diſtinguiſhed; and the volatile alkali *ammonium*, from ſal ammoniac which contains it in great quantity. The compound ſalts may be diſtinguiſhed into double, triple, and quadruple; though, in the ſcheme given in the work, the firſt diviſion is omitted, as tending only to create confuſion. The irregular ſalts, conſiſting of thoſe which are triple and quadruple, are admitted. Such as are imperfect by reaſon of an exceſs of acid, he ſays, are beſt denominated by converting the adjective, expreſſive of the baſe, into a participle; a practice which, on many occaſions, though countenanced by the authority of a late eminent writer, ſeems aukward and ſtiff. The exceſs of acid is denominated by the word *hyperoxys*, and a defect of it by *hypoxys*. Hence his denominations are formed in the following manner.

Salts with exceſs of acid. Cream of tartar, or *tartarus ſpodatus*, or *tartaroxys ſpodicus*. Acid vitriolated tartar, or vitriolum ſpodatum, *vitrioloxys ſpodicus*.

The ſalts which are imperfect from a defect of acid have their denominations by mentioning the baſe before the acid, and expreſſing the former ſubſtantively, the latter adjectively. Thus,

New chemical nomenclatures.

Salt of tartar, aerated vegetable alkali, ſpodium aerocraticum,	Oxyſpodium, aerocraticum.
Aerated volatile alkali, ammoniacum aerocraticum,	Oxyammonium aerocraticum.
Chalk, or calx aerocratica,	Oxycalcitis aerocraticus.
Borax, or natrum boracicum.	Oxynatrum boracicum.

With reſpect to other terms, Mr Wiegleb expreſſes the acid with which any baſe is combined, by the termination *cratia*, from the Greek κρατος *(robur)*, added to it; excepting only thoſe with the nitrous and muriatic acids: and theſe (for what reaſon does not appear) he calls *Aponitra* and *Epimuriæ*. His genera of ſalts are as follow.

1. Vitriols *(Sulphurocratia)*. 2. Nitres *(Aponitra)*. 3. Murias *(Epimuriæ)*. 4. Boraxes. 5. Fluoricrates. 6. Arſenicrates. 7. Barylithicrates, (thoſe with acid of tungſten). 8. Molybdænocrates. 9. Photocrates, (with acid of phoſphorus). 10. Electrocrates. 11. Oxycrates, (with the acetous acid); or *epoxycrates*, with the aerated acid). 12. Tartars; or, with the acid changed by fire, *pyro-tartars*. 13. Oxalidicrates. 14. Cecidocrates (with the acid of galls). 15. Citriocrates. 16. Melicrates (with the acid of apples). 17. Benzicrates. 18. Xylocrates. 19. Gummicrates. 20. Camphoricrates. 21. Aerocrates. 22. Galacticrates. 23. Gala-melicrates (with acid of ſugar of milk). 24. Myrmecicrates. 25. Cyanocrates (with the colouring matter of Pruſſian blue). 26. Steatocrates. 27. Bombycicrates. 28. Zoolithocrates, (with acid of calculus).

On the ſubject of nomenclatures it is obvious to remark, that whatever may be the defects of the old one, we are ready to be involved in much greater difficulties by the introduction of a new one. Or ſuppoſing a new language to be adopted, where would be the ſecurity for its permanence? That which appears moſt ſpecious at one period, may ſtill be ſuperſeded by the refinements of another; and colourable pretenſions would never be wanting to ſucceſſive innovators. Hence a continual fluctuation, and an endleſs vocabulary. As the nomenclature firſt abovementioned, however, has attracted no ſmall degree of attention, we ſhall here ſubjoin a ſcheme of it, as well for the ſatisfaction of our readers in general, as for the gratification of thoſe in particular who may have imbibed the doctrines of its authors.

[Follows *The Whole-ſheet Table.*]

TABLE, ſhowing the Manner in which Natural Bodies, conſidered in a Chemical View, may be divided into Claſſes; with their ſeveral Subdiviſions; their Properties defined; and the Manner in which they are obtained, pointed out.

NATURAL BODIES, conſidered as the Objects of Chemiſtry, may be divided into the following Claſſes, viz.
1. SALTS. 2. EARTHS. 3. METALS. 4. INFLAMMABLES. 5. WATERS. 6. AIRS.

I. SALTS.

THESE are ſoluble in water, ſapid, and not inflammable. They are either ACIDS or ALKALIES.

I. *Acids* are diſtinguiſhed by turning ſyrup of violets red, or forming with alkalies neutral ſalts; and are ſuppoſed to conſiſt of dephlogiſticated air condenſed, as their acidifying principle. The different acids yet known are,

1. *Vitriolic, fixed.* The moſt ponderous of all fluids next to mercury, the moſt fixed in the fire, and the moſt powerful as a ſolvent of all the acids. Obtained chiefly from ſulphur by inflammation.
2. *Vitriolic, volatile.* Obtained alſo from ſulphur by inflammation; air being admitted during the proceſs. It acts leſs powerfully as a ſolvent than when in its fixed ſtate.
3. *Nitrous* or *Aquafortis:* a volatile fluid, generally met with of a reddiſh colour, and emitting noxious fumes, when in its concentrated ſtate; though this is found not to be eſſential to it, but owing to a mixture of phlogiſton. In its pure ſtate it is almoſt as colourleſs as water, and ſmokes very little. It is next in ſtrength to the vitriolic acid, and obtained chiefly from nitre. It conſiſts of dephlogiſticated and phlogiſticated air condenſed, and may be obtained by taking the electric ſpark for a long time in a mixture of theſe. By uniting with ſome metals it appears to be converted into volatile alkali.
4. *Muriatic,* or *ſpirit of ſea-ſalt.* A volatile fluid, generally of a fine yellow colour; though this alſo is owing to the admixture of foreign ſubſtances, generally of iron. Inferior in power to the former, and obtained from ſea-ſalt. Naturally this acid ſeems to be in an aerial ſtate, but eaſily contracts an union with water. On mixture with mangane ſe, it is wholly converted into a yellow, and almoſt incondenſible vapour, called *dephlogiſticated ſpirit of ſalt;* but which, on mixture with inflammable air, recompoſes the marine acid.
5. *Fluor acid.* Obtained from a ſpecies of ſpar: has little acid power, but is remarkable for its property of corroding glaſs.
6. *Acid of borax,* or *ſedative ſalt.* Obtained from borax in the form of ſcaly cryſtals; found alſo naturally in ſome waters in Italy, and in certain minerals in other countries.
7. *Acetous acid.* Obtained by allowing any fermentable liquor to proceed in the fermentation till paſt the vinous ſtate. It is much leſs corroſive, and leſs powerful as a ſolvent, than the vitriolic, nitrous, or marine acids.
8. *Acid of tartar.* Procured from the hard ſubſtance called *tartar,* depoſited on the ſides of wine veſſels.
9. *Acid of ſugar.* Found naturally in the juice of ſorrel, and procured artificially by means of nitrous acid from ſugar and a great variety of other ſubſtances. Aſſumes a dry form.
10. *Acid of phoſphorus.* Obtained artificially from urine, and in large quantity from calcined bones; found naturally in ſome kinds of lead-ore; and in vaſt quantities in Spain united with calcareous earth. Aſſumes a ſolid form, and melts into glaſs.
11. *Acid of ants.* Procured from the animal from which it takes its name, by expreſſion or diſtillation, in a fluid form.
12. *Acid of amber.* Obtained in a ſolid form from amber.
13. *Acid of arſenic.* Obtained from that ſubſtance by means of nitrous acid. Is extremely fixed in the fire.
14. *Acid of molybdæna.* Procured from that ſubſtance by means of nitrous acid. Reſembles a fine white earth.
15. *Acid of lapis ponderoſus, tungſten,* or *wolfram.* Obtained as an acid, *per ſe,* from this ſubſtance by Mr Scheele; but its real acidity is denied by other chemiſts. Is in the form of a yellow powder.
16. *Acid of milk.* Obtained in a fluid form from that liquor.
17. *Acid of ſugar of milk.* Obtained in form of a white powder, by means of nitrous acid, from ſugar of milk.
18. *Lithiſiac acid* Obtained in a ſolid form from human calculus, by means of nitrous acid.
19. *Acid of benzoin.* Obtained in a ſolid form from that gum by ſublimation or lixiviation with quicklime.
20. *Acid of lemons.* Obtained from the juice of that fruit by cryſtallization.
21. *Sebaceous acid,* or *acid of fat.* Obtained in a fluid ſtate from ſuet by diſtillation.
22. *Acid of citrons.* Obtained in a fluid ſtate from the juice of that and other fruits.
23. *Acid of apples.* Obtained in a fluid ſtate from the juice of apples and other fruits.
24. *Acid of ſorrel.* Obtained in a ſolid form from the juice of that plant; the ſame with acid of ſugar.

II. *Alkalies.* Theſe turn ſyrup of violets green, and with acids form neutral ſalts. They are,

1. *Fixed vegetable,* or *Pot-aſh.* Always obtained from the aſhes of burnt vegetables. A deliqueſcent ſalt.
2. *Fixed foſſile.* A ſolid cryſtalline ſalt, ſometimes found native, as the natrum of Egypt; and ſometimes by burning ſea-weed as kelp.
3. *Volatile.* Obtained from ſal ammoniac, from the ſoot of burning bodies, and from the putrefactive fermentation. It is naturally in the ſtate of an inviſible and elaſtic vapour, conſtituting a ſpecies of aerial fluid, and conſiſts of phlogiſticated and inflammable air.

ACIDS, by their union with other bodies, form

Neutral Salts.	*Earthy Salts.*	*Metallic Salts.*	*Eſſential Salts.*
Theſe are always compoſed of an acid and an alkali, and are of many different kinds, as may be ſeen in the following table.	Compoſed of an acid joined to an earthy baſis, as alum and gypſum. See the following table.	Formed of an acid and metal. The principal of theſe are vitriols: the others may be ſeen in the following table.	Obtained from vegetables, and contain an acid joined with the juices of the plant in a particular manner not to be imitated by art. To theſe belong ſugar, manna, honey, and others of that ſort.

II. EARTHS.

THESE are ſolid bodies, not ſoluble in water, nor inflammable; and if fuſed in the fire, never reſume their earthy form again, but take that of glaſs. They are divided into *abſorbent*, *cryſtalline*, and *argillaceous*.

I. *ABSORBENT Earths* are capable of being united with acids, and are either calcareous, or not calcareous.

a, The calcareous abſorbent earths are,

1. *Limeſtone*, or *marble*. This is of infinite variety as to colour and texture. Marble is the hardeſt and fineſt. Thoſe kinds of limeſtone which feel unctuous to the touch, are generally impregnated with clay: thoſe that feel gritty, or where the lime is hard and weighty, contain ſand; this is the beſt for building; the other for manure.
2. *Chalk*. A white, friable, ſoft ſubſtance. This is much more free of heterogeneous matters than any limeſtone, and is eaſily calcined into quicklime. It is probably nothing elſe than limeſtone ſuddenly concreted without being cryſtallized.
3 *Sea ſhells*, are likewiſe a calcareous earth, and yield a very fine quicklime. Theſe are uſed in medicine.
4. *Terra ponderoſa*. A fine white earth ſometimes found combined with fixed air, but more commonly with the vitriolic acid; and forming with it a very heavy compound, named *ſpathum ponderoſum*. It is found in mines and veins of rocks.

b, The abſorbent earths which cannot be reduced into quicklime are,

1. *Magneſia alba*. A white earth, uſually found combined with the vitriolic acid, and forming bitter purging ſalt. It is likewiſe obtained from the mother-ley of nitre, the aſhes of burnt vegetables, *&c.*
2. *Earth of alum*. A particular kind of abſorbent earth, found in many places mixed with ſulphureous pyrites, as in Yorkſhire, &c. Clay of any kind may by a particular proceſs be converted into this earth.
3. *Earth of animals*. This is obtained by the calcination of animal ſubſtances, and by precipitation in the proceſs for making acid of milk. It can hardly be converted into glaſs; and is therefore uſed as a baſis for white enamels, &c. It is ſaid to conſiſt of the phoſphoric acid united to calcareous earth.

II *CRYSTALLINE or VITRESCENT Earths*, are hard, and ſtrike fire with ſteel; may be calcined in the fire; but are not ſoluble in acids.

Of this kind are,

1. *Sand* and *Flint*; found plentifully every where. With alkaline ſubſtances they are eaſily changed into glaſs; and hence are termed *vitreſcent*.
2. *Precious ſtones* of all kinds are likewiſe referable to this claſs; but they are of a much greater degree of hardneſs and tranſparency than the others.

III. *ARGILLACEOUS Earths* are digſtinguiſhed by acquiring a very hard conſiſtence when formed into a paſte with water, and expoſed to a conſiderable degree of heat; not ſoluble in acids. They are,

1. *Common clay*. It is of many different colours; but chiefly red, yellow, or white. The pureſt is that which burns white in the fire.
2. *Medical boles*. Theſe are of different ſorts; but are only a purer kind of clay, ſometimes mixed with a little iron or other matters.
3. *Lapis nephriticus*, or *ſteatite*. Theſe are indurated clays, found in various parts. They are at firſt ſoft and readily cut; but turn extremely hard in the air. Many other varieties of theſe earths might be mentioned; but as they do not differ in their chemical properties ſo much as in their external appearance, and being all mixed with one another, they more properly belong to the natural hiſtorian than the chemiſt.

III. METALLIC SUBSTANCES.

THESE are bodies of a hard and ſolid texture; fuſible in the fire, and reſuming their proper form afterwards; not miſcible with water, nor inflammable. They are divided into *Metals and Semimetals*.

I. *METALS* are malleable; and the ſpecies are,

1. *Gold*. The moſt ponderous and fixed in the fire of all bodies except platina, and the moſt ductile of any. It has a yellow colour, and is more commonly found in its metallic ſtate than any other metal. It has no proper ore; but is found in ores of ſilver, and almoſt all ſands contain ſome of it.
2. *Silver* is next to gold in malleability and ductility; but leſs fixed in the fire than either it or platina. It is ſometimes found in its native ſtate; but moſt commonly in that of an ore with ſulphur, ſometimes with arſenic, and aſſuming different appearances.
3. *Platina*. A white metal of a greater ſpecific gravity than gold, and altogether as fixed in the fire; the moſt difficult to be melted of all known ſubſtances; reſiſting the teſts which have uſually been applied for diſcovering the purity of gold, ſuppoſed from hence to be the *ſmiris* of the ancients. Found in South America.
4. *Copper*. Of a reddiſh colour, hard and ſonorous; admits of being extended greatly under the hammer, either hot or cold. Is difficult of fuſion. It is generally found in the ſtate of an ore with ſulphur. There are a great variety of ores of it, extremely beautiful, blue, red, green, and yellow.
5. *Iron*. A grey-coloured metal, extremely ductile when hot; the lighteſt of them all except tin. It is the only metal certainly known to admit of being welded; though platina is likewiſe ſaid to poſſeſs ſome ſhare of this property. It is likewiſe the only one capable of being tempered by cooling. It is found almoſt every where; and its ores are infinitely various.
6. *Tin*. A white ſoft metal, the lighteſt of the whole, and very ductile. The ores of it are generally arſenical, and aſſume a cryſtalline appearance; their colour being moſt uſually of a dark brown, and ſometimes very beautiful.

. *Lead*. A metal of a dull bluiſh colour, exceedingly ſoft and malleable, and very weighty. Seldom found in its metallic ſtate, but uſually in an ore with ſulphur or arſenic; but ſeldom with ſulphur alone. The principal ores of it are the cubic, called *galena* and the glaſſy, called *ſpar*.

8. *Mercury or quickſilver*; formerly accounted a ſemimetal, on account of its fluidity, but now reckoned among the moſt perfect metals. It is a white, opaque, metallic body; fluid, except in a very intenſe degree of cold; very heavy, and eaſily volatilized by heat. Sometimes found in its fluid form, but uſually in a beautiful red ore with ſulphur, called *cinnabar*.

II. *Semimetals* are brittle, and do not ſtretch under the hammer. They are,

1. *Zinc*. A bluiſh white ſubſtance of a fibrous texture, conſiderably hard and ſonorous, with a ſmall degree of ductility; eaſily fuſed and volatilized. Its principal ore is lapis calaminaris.
2. *Biſmuth* or *tin-glaſs*. A white ponderous, hard, brittle and ſonorous body, of a plated texture; eaſily fuſed and vitrified. It is only reduced to an ore by arſenic. Its appearance much the ſame with regulus of antimony.
3. *Antimony*. A blackiſh ſubſtance, of a fibrous needle-like texture; hard, brittle, and of a conſiderable weight; not difficult of fuſion, and eaſily convertible into glaſs. Its only ore is with ſulphur, which is the crude antimony.
4. *Arſenic*. A bright, ſparkling, whitiſh-coloured ſemimetal; of a plated texture; very brittle, and extremely volatile. It is generally found in the ores of others metals.
5. *Cobalt*. A brittle ſemimetal fuſible in a moderate heat, and eaſily convertible into a beautiful blue glaſs, called *ſmalt*. It is always obtained from an arſenical ore, likewiſe called *cobalt*.
6. *Nickel*. A reddiſh white ſubſtance, of a cloſe texture, and very bright; eaſily melted, but very difficult to vitrify.

IV. INFLAMMABLE SUBSTANCES,

Are thoſe which continue to burn of themſelves when once ſet on fire. They are divided into *oils*, *ſulphur* or *brimſtone*, *alcohol* or *ardent ſpirits* and *charcoal*.

I. *Oils* are thickiſh, viſcous fluids, not miſcible with water. Divided into *animal*, *vegetable*, and *foſſile*.

a, *b*, The animal and vegetable oils are,

1. *Expreſſed*. Theſe are of a mild and bland taſte, inodorous, and not ſoluble in alcohol. They are obtained by expreſſion, as oil of olives, rape-ſeed, almonds, &c. Animal fats are of the ſame nature, as is alſo wax.
2. *Eſſential*. Theſe are always obtained by diſtillation, poſſeſs the taſte and flavour of the ſubject from whence they are drawn, and are ſoluble in alcohol. Of this kind are oil of cloves, ſpike, &c. The oil of ants is an example in the animal kingdom.
3. *Empyreumatic*. Theſe are obtained by a conſiderable degree of heat, and poſſeſs an acrid taſte and burnt-like flavour, as oil of hartſhorn. They are ſoluble in ſpirit of wine.

c. *Foſſile oils*. Theſe are found in the earth in their native ſtate; and are called, when pure, *naphtha*; which is of an acrid taſte, and extremely volatile, not miſcible with alcohol. A great many inflammable foſſils contain this, as bitumens, pit-coal, &c.

II. *Sulphur or Brimstone*. This is a dry friable ſubſtance, not miſcible with water. It is found in many mineral ſubſtances, metallic ores, &c. but is for the moſt part met with in pyrites. Great quantities of it are found in the neighbourhood of volcanoes.

III. *Alcohol or Ardent Spirits*. This is a fluid of an acrid and volatile nature, miſcible with water; obtained from fermented vegetable juices by diſtillation; as from the juice of the grape, malt-liquors, rice, &c.

IV. *Charcoal*. The reſiduum of moſt inflammable matters after undergoing diſtillation with a ſtrong fire. A black ſubſtance, acted upon with difficulty by acids; ſoluble in hepar-ſulphuris, and entirely diſſipable into inflammable air by a very violent heat. Of great uſe as fuel, and eſſentially neceſſary in metallurgy and other arts.

V. WATER.

A colourleſs inſipid fluid well known. It is either *ſimple* or *mineral*.

I. *Simple*, or *pure-rain-water*, as it called, though the moſt homogeneous fluid of this kind with which we are acquainted, is not perfectly pure, but always contains a portion of mucilaginous matter, which can never be perfectly ſeparated. It is ſuppoſed to conſiſt of dephlogiſticated and inflammable air condenſed.

II. *Mineral waters* are theſe ſpring-waters impregnated with ſaline ſubſtances; the diverſity of which is exceeding great; but they all agree in having an acid joined with them. The moſt common ſorts are impregnated with iron and ſulphur.

VI. AIR.

An inviſible and permanently elaſtic fluid, is of the following kinds: *Dephlogiſticated*, *phlogiſticated*, *fixed* or *fixable*, *inflammable*, *nitrous*, *vitriolic acid air*, *marine acid air*, *dephlogiſticated marine acid*, *alkaline air*, *hepatic air*, *atmoſpherical air*.

1. *Dephlogiſticated*. An elaſtic fluid naturally extricated in the proceſs of vegetation; artificially procured from nitre, minium, manganeſe, water, &c. eminently capable of ſupporting flame and animal life. One of the component parts of our atmoſphere.

2. *Phlogiſticated.* Produced in great quantities during the putrefactive fermentation; obtained alſo in the calcination of metals and other phlogiſtic proceſſes. Deſtroys animal life, and extinguiſhes flame, but is very friendly to vegetation. Is another of the component parts of our atmoſphere.
3. *Fixed*, or *fixable.* Has its name from the property of adhering to certain bodies, and fixing itſelf in them. Conſiſts of dephlogiſticated air united to charcoal. Is obtained by fermentation, and in all phlogiſtic proceſſes. Manifeſts the properties of an acid: extinguiſhes flame, and deſtroys animal life.
4. *Inflammable.* Conſiſts wholly of charcoal and a little water rarefied by heat; is remarkable for being the lighteſt of all gravitating ſubſtances. Is produced naturally in mines, and from putrid waters; artificially procured from certain metallic ſolutions, by paſſing the ſteam of water over red-hot iron; by diſtilling wood, pit-coal, &c. with a ſtrong heat; or by expoſing charcoal to the heat of a burning lens *in vacuo.* It extinguiſhes flame unleſs it be mixed with a certain proportion of atmoſpherical or dephlogiſticated air; in which caſe it explodes violently, deſtroys animal life, but is friendly to vegetation.
5. *Nitrous.* Procured artificially in diſſolving metallic or other ſubſtances in the nitrous acid. On mixture with dephlogiſticated air both the fluids loſe their elaſticity, and a ſmall quantity of nitrous acid is produced. It inſtantly kills animals, and extinguiſhes flame. By union with ſome metals is converted into volatile alkali. In ſome caſes it may be made to ſupport flame, and even animal life. Its property of condenſing along with phlogiſticated air renders it a teſt of the ſalubrity of the atmoſphere.
6. *Vitriolic acid air.* The ſame with volatile or ſulphureous vitriolic acid.
7. *Marine acid air.* The ſame with marine acid reduced into vapour, and deprived of moſt of its water.
8. *Dephlogiſticated marine acid.* Suppoſed by ſome to be the marine acid deprived of its phlogiſtion; by others to be the ſame acid with an addition of pure air. It deſtroys many kinds of colours; whitens linen, and with inflammable air regenerates common marine acid.
9. *Alkaline air.* The ſame with pure volatile alkali; is formed by an union of phlogiſticated and inflammable air.
10. *Hepatic air.* Produced from the decompoſition of liver of ſulphur by acids, or in the common atmoſphere. It is inflammable, but does not burn with exploſion.
11. *Atmoſpherical air.* Compoſed of dephlogiſticated and phlogiſticated air; and thus ſupports both animal life and vegetation.

TABLE, ſhowing the ſeveral Combinations that the SIMPLE CHEMICAL ELEMENTARY BODIES admit of with one another; the Compound reſulting from that Mixture; and the Manner in which the Union is effected: With ſome Account of the principal Uſes to which theſe are applied in Arts or Manufactures.

N. B. This mark*, put above any word, denotes that there is ſome difficulty in the proceſs, or that the union is not very complete.

VITRIOLIC ACID may be combined with the following ſubſtances, viz.

ACIDS.		NITROUS ACID. A mixture which readily inflames oils. By ſolution, generating heat.
		MURIATIC, VEGETABLE, and all other ACIDS yet known. By ſolution, generating heat. But theſe mixtures are applied to no particular uſe in medicine or arts.
ALKALIES.	VEGETABLE.	*Vitriolated tartar.* By ſolution and cryſtallization, or double elective attraction from a great variety of bodies.
		Nitrum vitriolatum. A vitriolated tartar, obtained by diſtilling from nitre with the vitriolic acid.
		Sal polychreſtum. By deflagrating nitre with ſulphur. There are many other kinds of vitriolated tartar, known formerly by different names, and ſuppoſed to be poſſeſſed of particular properties, but they are now neglected.
	FOSSILE.	*Glauber's ſalt.* By ſolution and cryſtallization. Much uſed in medicine as a gentle purgative.
	VOLATILE.	*Secret ammoniac.* By ſolution. Formerly ſuppoſed a moſt powerful menſtruum for metals, &c. but without any juſt foundation.
EARTHS.	CALCAREOUS EARTHS.	A corroded calx. By ſimple corroſion. This when perfectly edulcorated with water is found to be a true gypſum.
		Selenites. By precipitation from a very dilute ſolution of chalk in the nitrous acid, by means of the vitriolic acid.
		Terra ponderoſa. With this it unites in preference to alkalies, forming a very heavy and inſoluble ſubſtance called *ſpathum ponderoſum.*
		Gypſum or *Paris-plaſter.* Often found in a native ſtate. May be artificially formed by precipitating from a ſolution of chalk in a very concentrated nitrous acid. Uſed as a cement: for taking impreſſions from medals, &c.
		Talc aſbeſtos, &c. A native production which connot be perfectly imitated by art. Uſed for holding objects in microſcopes, making incombuſtible cloth, &c.
	MAGNESIA.	*Epſom*, or *magneſia Glauber's ſalt.* By ſolution and cryſtallization. Much uſed in medicine for the ſame purpoſes as real Glauber's ſalt.

EARTHS.

EARTH of ALUM. *Alum.* By ſolution, cryſtallization, &c. Uſed by dyers as a preparatory for taking on the colours, papermakers, goldſmiths, &c.

EARTH of ANIMALS, OSTEOCELLA, &c. By ſolution. The mixtures of theſe are not applied to any particular uſe.

CLAY*. *Alum.* By digeſting pure clay for ſome time in this acid, and expoſing it for ſome time to the air, an alum is produced; and if the clay is precipitated from this aluminous concrete, it is found to be a pure earth of alum, ſoluble in all acids.

FLINT. A thickiſh coagulum. By digeſting the liquor ſilices in the vitriolic acid.

METALS.

GOLD*. Imperfectly. By a particular proceſs after being ſeparated from aqua-regia.

SILVER*. By ſolution, after it has been precipitated from the nitrous acid by alkalies. The fumes which ariſe in this ſolution are inflammable.

COPPER. *Blue vitriol.* This is ſometimes a native production, but in this way it is never pure. It is artificially prepared by ſolution in a very concentrated acid, and cryſtallizing it.

IRON.
- *Green vitriol* or *copperas.* Obtained at large by particular proceſs from pyrites; or by ſolution, &c. in a diluted acid. This is the baſis of all black dyes, ink, &c. as it ſtrikes a black colour with vegetable aſtringents.
- *Salt of ſteel.* By calcining the cryſtals of green vitriol till they are converted into a white powder.
- *Colcothar of vitriol.* By continuing the calcination till it aſſumes a brown colour.

LEAD.
- *Saturnus vitriolicus.* A ſolution in a boiling heat, but is again precipitated when cold.
- An indiſſoluble concrete. By precipitation from the nitrous acid.

TIN. *Jupiter corroſivus.* By a boiling heat in a concentrated acid.

MERCURY.
- *Ignis Gehenne*, or infernalis of Paracelſus. By a boiling heat, and repeated coctions with freſh acid when it is evaporated.
- *Turpeth mineral*, or mercurius precipitatus flavus. By evaporating to dryneſs, and then waſhing with water.

SEMIMETALS.

ANTIMONY*. *A metallic ſalt.* By elective attraction from butter of antimony.

ZINC. *White vitriol.* Often found in its native ſtate. Artificially made by ſolution and cryſtallization in a diluted acid. Uſed by painters for drying.

BISMUTH. A corroded calx. By ſolution in a concentrated acid.

ARSENIC - - - By ditto.

COBALT. A roſe-coloured mixture. By ſolution. If this is precipitated by a fixed alkali, and again diſſolved, the liquor appears of a beautiful red.

OILS.

EXPRESSED. A blackiſh gummy-like maſs. By ſolution, generating a conſiderable heat. Native gums are ſuppoſed to owe their origin to a mixture of this kind.

ESSENTIAL. A dark-coloured reſinous maſs. A great heat and violent effervescence being produced by this mixture. Native reſins ſuppoſed the ſame.

EMPYREUMATIC. Little known. By ſolution.

FOSSILE. A ſubſtance reſembling amber. By ſolution.

SULPHUR*. Here there is no proper union of ſubſtances; but if ſulphur is boiled in this acid, it becomes leſs inflammable and more fixed than any ordinary ſulphur.

ALCOHOL.

Vitriolic ether. By careful ſolution and diſtillation, the ether being ſeparated by the addition of water.

Spiritus vitrioli dulcis. By ſolution and diſtillation.

Oleum dulce. By continuing the heat after the ether has ariſen.

Oleum anodynum minerale. By rediſtilling the reſiduum of the laſt with alcohol. A medicine much celebrated by Hoffman.

Sulphur. By puſhing the heat after the oil comes over. It is to be obſerved that this is produced in every combination of this acid with inflammables or metals.

WATER. An acidulated water. Sometimes, though ſeldom, found iſſuing along with native ſprings. Applied to no particular uſe.

NITROUS ACID may be combined with the following Subſtances, viz.

ACIDS.

VITRIOLIC, as above.

MURIATIC. *Aqua-regia.* By ſolution. This is the only proper menſtruum for gold; and it is a ſolution of tin in this menſtruum which is the baſis of the ſcarlet dye.

VEGETABLE, and all others. By ditto. Theſe compounds have no particular names, nor are applied to any particular uſes in medicine or arts.

ALKALIES.

VEGETABLE. *Common nitre.* A native production. Made artificially by ſolution and cryſtallization. This deflagrates with oily or metallic bodies, and is the foundation of gun-powder.

FOSSILE. *Cubic nitre.* By ſolution.

VOLATILE. *Nitrous ammoniac.* By ſolution. This differs from all the other ammonical ſalts, by being ſoluble in alcohol.

EARTHS.

CALCAREOUS.
- *Deliqueſcent cryſtals.* By ditto and cryſtallization.
- *Baldwin's phoſphorus.* By ditto and evaporating to dryneſs.

EARTH of ALUM, and all other abſorbent earths. By ſolution. The compounds have no names nor any remarkable properties hitherto diſcovered.

CRYSTALLINE EARTHS*. By ſolution after precipitation from the liquor ſilices.

METALS.

METALS.	Gold*.	*Slightly impregnated.* By a boiling heat in cloſe veſſels, after the ordinary method of ſeparating ſilver from gold by the nitrous acid. It ſpontaneouſly ſubſides in the air.
	Silver.	*A fluid ſolution.* By ſolution. This when diluted with water ſtains hair and bones black; as alſo marble, agate, jaſper, &c. of different colours.
		Sal metallorum. By ſolution and cryſtallization.
		Catharticum lunare, lunar cauſtic, or *lapis infernalis.* By inſpiſſating the ſolution to dryneſs.
	Copper.	A green-coloured ſolution. By ſolution.
	Iron.	A greeniſh ſolution, if a diluted acid is employed; if otherwiſe, it is of a yellowiſh colour: evaporated to dryneſs, it deliquates in the air.
	Lead.	A yellow ſolution. By diſſolving in a diluted acid. If much water is added, the metal is precipitated.
		Saturni fulminans. By inſpiſſating the ſolution. This explodes when put upon the fire with greater force than nitre, and has been propoſed to be uſed as an ingredient in gun-powder to augment its force.
	Tin.	A ſolution or corroded calx. By a careful ſolution without heat it remains ſuſpended; if otherwiſe, it falls down in form of a calx. This is commonly ſuppoſed to be the compoſition uſed in dyeing ſcarlet; but by miſtake: for it is a ſolution of tin in aqua-regia that communicates that fine colour to cochineal. The ſame ſolution is the baſis of the powder which tinges glaſs of a ruby colour. It is the precipitate of gold from aqua-regia by means of tin.
	Mercury.	A limpid ſolution, intenſely corroſive. By ſolution.
		Red precipitate. By evaporating the ſolution to dryneſs, and then calcining till it becomes red.
		Mercurius corroſivus fuſus. By precipitating from the nitrous acid by fixed alkali.
		White precipitate - By ditto with the volatile alkali.
SEMIMETALS.	Bismuth.	A greeniſh ſolution. By uſing a concentrated acid. This might be applied in ſome caſes in the art of dyeing; but is not yet come into general uſe.
		Magiſtery of biſmuth. By precipitating from the ſolution by means of water. This has been employed as a coſmetic, but is inefficacious and unſafe. If mixed with pomatum, this ſtains hair of a dark colour without injuring it.
	Zinc.	A corroded ſolution. By the ordinary means.
	Antimony.	A colourleſs calx. By ſimple corroſion.
		Bezoardic mineral. By diſtilling from butter of antimony, after having added the nitrous acid.
		Antimonium diaphoreticum. By adding nitre to crude antimony, and deflagrating.
		Ceruſa antimonii. By deflagrating regulus of antimony with nitre.
	Cobalt.	A red liquor. By ſolution either in its calcined or metallic ſtate.
		Roſe-coloured cryſtals. By adding muriatic acid, and allowing it to cryſtallize.
		Green ſympathetic ink. By diſſolving theſe cryſtals in water. The ſolution is red when cold, and green when warm; when wrote with, it diſappears when dry; but when held to the fire it becomes green; and again diſappears when cold.
	Nickel.	A green-coloured liquor. By ſolution.
OILS.	Expressed.	A thick bituminous-like ſubſtance. Upon the mixture a conſiderable degree of heat is generated, and ſometimes, though very ſeldom, actual flame is produced.
	Essential.	Ditto. A more violent heat is generated upon the mixture with theſe oils than any other, and with many of them an actual flame is produced.
	Empyreumatic.	This mixture has no name, nor is it applied to any remarkable uſe in arts.
	Fossile.	Ditto.
ALCOHOL.		*Nitrous ether.* By digeſting; the ether ariſing to the ſurface.
		Spiritus nitri dulcis. By digeſting a little, and then diſtilling.
WATER.		*Acidulated water.* By ſolution.

The MURIATIC ACID may be combined with the following Subſtances. viz.

ACIDS.	Vitriolic and Nitrous.	As in the former part of this Table.
	Vegetable,	and all others yet known. By ſolution: but as none of theſe mixtures are applied to any particular purpoſe, we take no notice of them.
ALKALIES.	Vegetable.	*Digeſtive ſalt.* By ſolution and cryſtallization.
	Fossile.	*Common ſalt.* Commonly obtained by evaporating ſea-water to dryneſs; or artificially made by mixing the acid and alkali, and cryſtallizing.
		Sal gem. A native foſſile ſalt, found in mines in Poland, Spain, *&c.* of the ſame nature as common ſalt, but more pure.
	Volatile.	*Common ammoniac.* Obtained at large by a particular proceſs from ſoot. Artificially made by mixing the acid and alkali, and cryſtallizing.
EARTHS.	Calcareous.	*Liquid ſhell.* By ſolution. A ſubſtance whoſe effects in medicine have been greatly extolled.
		Ol. calcis per deliquium. By evaporating liquid ſhell to dryneſs. It naturally deliqueſces.
		Fixed ammoniac. By ſolution and cryſtallization. This ſometimes appears luminous in the dark when ſtruck with a hammer.
	Osteocella, Magnesia,	and other abſorbents. By ſolution: but the properties or uſes of theſe are not known.

METALS.	GOLD*,	*A yellow liquor.* By boiling a calx of gold (in whatever way obtained) in this acid. It does not act upon it in its metallic ſtate.
	SILVER*.	*A fluid ſolution.* By diſſolving the ore of ſilver in this acid. It does not act upon pure metallic ſilver.
		Luna cornea. By elective attraction from the nitrous acid.
	PLATINA*.	A fluid ſolution. With difficulty effected, after having been precipitated from aqua-regia by alkalies.
	COPPER.	*A green deliqueſcent inflammable ſalt.* By ſolution and inſpiſſating to dryneſs.
	IRON.	*Tinctura martis aurea.* By ſolution. The iron is in ſome meaſure rendered volatile by the operation.
	LEAD.	A limpid ſolution. By a boiling heat, and frequent cohobations with freſh acid.
		Cornea Saturni. By precipitation from the nitrous acid.
	TIN*.	A corroded powder. By ſimple corroſion.
		Butter of tin. By diſtilling from corroſive ſublimate.
	MERCURY*.	A colourleſs cryſtalline maſs, extremely acrid. By corroſion, employing the fumes of a very concentrated acid.
		Mercur. corroſiv. albus. By precipitation from the nitrous acid.
		Corroſive ſublimate. By ſubliming from ſal ammoniac, common ſalt, or many other bodies.
		Mercurius dulcis. By reſubliming corroſive ſublimate with more quickſilver.
		Mercurial panacea. By ſubliming corr. ſub. nine times, and digeſting for ſome time in ſpirit of wine.
SEMIMETALS.	BISMUTH*.	A ſolution very ſlightly impregnated. By employing a very concentrated acid.
	ZINC.	A ſolution of a very ſlight yellow colour.
	ARSENIC*	*Butter of arſenic.* By diſtilling corroſive ſublimate with arſenic; the arſenic uniting with the acid, and leaving the mercury.
	COBALT.	A reddiſh ſolution. By the ordinary means. It becomes green by a gentle heat.
	NICKEL.	A green ſolution. By the ordinary means.
OILS*.		By ſolution. The union here is but imperfect, nor have they any particular name.
ALCOHOL.		*Spiritus ſalis dulcis.* By digeſtion, and afterwards diſtilling. The acid here is never totally dulcified.
WATER.		*Acidulated water.* Generating heat by mixture.

VINEGAR may be combined with the following Subſtances, viz.

ACIDS.	VITRIOLIC, NITROUS, and MURIATIC,	as in the above table. It likewiſe unites with all other acids, generating heat; but the properties or uſes of theſe are not known.
ALKALIES.	VEGETABLE.	*Regenerated tartar.* By ſolution and cryſtallization.
	FOSSILE.	*Polychreſt of Rochelle.* By ditto.
	VOLATILE.	*Spiritus Mindereri* By ſolution.
EARTHS.	CALCAREOUS EARTH.	*Earthy ſalts.* Not known in medicine or arts.
	MAGNESIA.	*Dr Black's purging ſalt.* By ſolution. It unites with all the other abſorbent earths; but the properties of theſe mixes are unknown.
METALS.	COPPER.	*Verdegris.* By ſolution and cryſtallization; or at large, by ſtratifying copper-plates with the huſks of the grape.
	IRON.	*Sal martis aperiens.* By ſolution and cryſtallization.
	LEAD.	*Ceruſe.* By expoſing, in certain circumſtances, thin plates of lead to the fumes of vinegar.
		Saccharum Saturni. By ſolution and cryſtallization.
	TIN*.	This is not properly diſſolved; but the acid is evidently impregnated. By the ordinary means of ſolution.
	MERCURY*.	*A fluid ſolution.* By employing a precipitate of mercury from the nitrous acid by alkalies.
		A red calx. By long digeſtion with fluid mercury.
SEMIMETALS.	ZINC.	A colourleſs ſolution of a ſweetiſh taſte. By digeſting for ſome time.
	ANTIMONY*.	*Vinum benedictum.* This it not a proper ſolution of the metal, but the acid is impregnated with an emetic quality.
	ARSENIC.	*Vinum arſenicum.* By ditto. A curious phoſphoric liquor.
	BISMUTH.	An auſtere ſtyptic liquor. By ſtrong coction.
OILS*.		The union here is imperfect, nor have any of them obtained particular names.
ALCOHOL.		A mixture much uſed for anointing ſprains, &c.
WATER.		*Acidulated water.*

ACID or TARTAR may be combined with the following ſubſtances, viz.

ALKALIES.	VEGETABLE.	Cream of tartar with exceſs of acid.
		Soluble tartar, when completely ſaturated.
ALKALIES.	FOSSILE.	Rochelle ſalt.
	VOLATILE.	A ſalt very difficult of ſolution with exceſs of acid.
		A beautiful and ſoluble ſalt when perfectly ſaturated.

EARTH.

EARTH.	Calcareous.	An indiſſoluble ſelenite.
METALS.	Copper.	A fine green colour for painting.
	Iron.	A green aſtringent liquid. Chalybeated tartar.
SEMIMETAL.	Regulus of Antimony.	Emetic tartar.

ACID of URINE may be combined with the following ſubſtances, viz.

ACIDS of all kinds.		The nature of theſe not known.
ALKALI.	Fixed Vegetable.	A ſalt not eaſily cryſtallized, the nature of which is not known.
	Fossile.	A fine cryſtallized ſalt uſed in medicine.
	Volatile.	A glaſs-like ſaline ſubſtance called *microcoſmic ſalt.* The acid is always found in this ſtate by evaporating urine.
VITRESCENT EARTHS.		A glaſs of different ſorts. By fuſion.
METALS.	Lead.	An inflammable malleable maſs. By calcining the dry ſalt with lead.
	Tin.	A maſs reſembling zinc; and inflammable. By ditto.
	Iron.	A true *phoſphorus.* By ditto.
		A bluiſh ſolution. By employing a watery ſolution of the acid.
	Copper.	A corroded powder, or green ſolution. By a boiling heat in a watery ſolution of the acid.
	Mercury.	A ſemi-opaque maſs. By fuſion with the acid, in its ſolid form.
SEMIMETALS.	Zinc.	A corroded powder, ſoluble in water. By ſolution in the acid in a watery ſituation.
		A true *phoſphorus.* By fuſion with the dry acid.
	Antimony.	A ſolution in the ordinary way.
		A brilliant ſtriated maſs. By fuſion with the dry acid.
	Bismuth.	A mixture but little changed in appearance from ordinary biſmuth. By fuſion.
	Arsenic.	A whitiſh ſemitranſparent deliqueſcent maſs. By fuſion.
	Cobalt.	A reddiſh tincture. By ſolution.
OILS.	*Baldwin's phoſphorus.*	By diſtilling with ſubſtances that contain oils or inflammable matter.

FLUOR ACID, may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable.	A gelatinous ſaline maſs which cannot be cryſtallized. Great part of it is alſo diſſipated by evaporation to dryneſs.
	Fossile.	A ſubſtance ſimilar to the foregoing.
	Volatile.	Lets fall a quantity of ſiliceous earth, and forms a cryſtallizable ammoniacal ſalt.
EARTHS.	Lime	A gelatinous matter.
	Magnesia.	
	Earth of Alum.	
	Siliceous Earth.	After long ſtanding, cryſtals of quartz.
METALS.	Silver	The calces of theſe metals partially diſſolved; but the properties of the ſolution unknown
	Quicksilver.	
	Copper.	The calx eaſily ſoluble, and affording blue cryſtals; the metal only partially ſo.
	Iron.	Diſſolved with violence with the emiſſion of inflammable vapours into an uncryſtallizable liquor.

ACID of SUGAR may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable.	A ſalt ſcarce capable of cryſtallization when perfectly neutral.
	Fossile.	A ſalt difficultly ſoluble in water.
	Volatile.	An ammoniacal ſalt ſhooting into quadrangular priſms.
EARTHS.	Lime.	A kind of ſelenite from which the acid cannot be ſeparated by a burning heat.
	Terra Ponderosa.	A ſalt formed into angular cryſtals, ſcarce ſoluble in water.
	Magnesia.	A white powder inſoluble without an exceſs of acid.
	Earth of Alum.	A yellow pellucid maſs incapable of cryſtallization, and liqueſying in the air.
METALS.	Gold.	The calces of all theſe metals diſſolved, but the nitre of the ſolutions unknown.
	Silver.	
	Platina.	
	Quicksilver.	
	Iron.	Diſſolved in great quantity, and forming a yellow priſmatic ſalt eaſily ſoluble in water.
SEMIMETAL.	Cobalt.	A yellow-coloured ſalt forming a ſympathetic ink with ſea-ſalt.
INFLAMMABLES.	Alcohol.	An ether which cannot eaſily be ſet on fire unleſs previouſly heated, and burning with a blue flame.

ACID of BORAX or SEDATIVE SALT may be combined with the following Subſtances, viz.

ALKALIES.	Fossle.	*Borax.* A native ſubſtance, which may be imitated by art. It is of great uſe in promoting the fuſion of metals and earths.
	Volatile.	An ammoniacal ſalt ſhooting into ſmall cryſtals, and melting by an intenſe heat into a greyiſh-coloured glaſs.
EARTHS.	Magnesia.	A ſalt cryſtallizable in vinegar and acid of ants. Decompoſed by other acids and ſpirit of wine.
	Earth of Alum.	In certain proportions a ſalt difficult of ſolution; in others a hard maſs reſembling pumice-ſtone, yet partially ſoluble in water.

METAL.	Iron. An amber-coloured ſolution yielding cryſtals of a yellow colour.
SEMIMETAL.	Arsenic. A cryſtallizable compound ſhooting into pointed ramifications, or forming a greyiſh, white, or yellow powder.
ALCOHOL.	A ſolution with a conſiderable heat, which burns with a green flame.
WATER.	A ſolution in a conſiderable heat. The other mixtures with this acid not known.

ACID of AMBER may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable. A tranſparent and cryſtallizable ſalt, but deliqueſcent.
	Fossile. A cryſtallizable ſalt not deliqueſcent.
	Volatile. An ammoniacal ſalt ſhooting into acicular cryſtals.
EARTHS.	Lime. A cryſtallizable ſalt, difficult of ſolution and not deliqueſcent. Decompoſed by common ſal ammoniac.
	Magnesia. A gummy deliqueſcent ſaline maſs, not cryſtallizable.
	Earth of Alum. A priſmatic ſalt incapable of decompoſition by alkalies.
METALS.	Silver. A ſalt ſhooting into thin oblong cryſtals obtained from the precipitate; but no ſolution of the perfect metal.
	Copper. A cryſtallizable ſalt of a green colour.
	Iron. A cryſtallizable ſalt of a brown colour.
	Tin. A cryſtallizable ſalt from the precipitate, ſcarce to be decompoſed by alkalies.
	Lead. A cryſtallizable ſalt from the precipitate.
SEMIMETALS.	Zinc. A cryſtallizable ſalt.
	Bismuth. A cryſtallizable ſalt from the precipitate, not to be decompoſed by alkalies.
	Regulus of Antimony. A ſolution of the precipitate.

ACID of ANTS may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable. A cryſtallizable ſalt, deliqueſcent in the air.
	Fossile. A ſalt of a ſimilar nature.
	Volatile. An ammoniacal liquor, cryſtallizable with difficulty.
EARTHS.	Chalk or Coral. A cryſtallizable ſalt which does not deliquate.
	Magnesia. A ſaline liquor ſcarcely cryſtallizable.
	Terra Ponderosa. A cryſtallizable ſalt which does not deliqueſce.
	Earth of Alum. Unites with difficulty, and ſcarcely to the point of ſaturation. The nature of the compound not known.
METALS.	Silver*. By ſolution. The calx of ſilver precipitated from aquafortis by alkalies; but does not act upon it in its metallic ſtate.
	Copper. Beautiful green cryſtals. By diſſolving and cryſtallizing calcined copper. It acts ſlowly upon it in its metallic ſtate.
	Iron. A cryſtallizable ſalt. It diſſolves this metal with great facility.
	Lead*. A ſalt reſembling ſaccharum ſaturni. By diſſolving the red calx of lead. But it does not act upon it in its metallic ſtate.
SEMIMETAL.	Zinc. Elegant cryſtals. By the ordinary means.

The effects of this acid upon other bodies, or the uſes to which theſe combinations might be applied, are not yet ſufficiently known.

ACID of ARSENIC may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable. A ponderous ſalt ſhooting into fine cryſtals by ſuperſaturation with acid.
	Fossile. A ſalt cryſtallizable when perfectly neutral.
	Volatile. A peculiar kind of ammoniacal ſalt parting with the alkali, and decompoſing ſome of it in a ſtrong fire.
EARTHS.	Chalk. A cryſtallizable ſalt ſcarcely ſoluble.
	Magnesia. A gelatinous maſs which cannot be cryſtallized.
	Terra Ponderosa. An inſoluble white powder.
METALS.	Copper. A green-coloured ſolution.
	Iron. A very thick gelatinous ſolution.
	Lead. A ſolution which cannot be cryſtallized.
	Tin. A gelatinous ſolution in the moiſt way. A mixture taking fire in cloſe veſſels in the dry way.
SEMIMETALS.	Zinc. A ſolution in the moiſt way, and in the dry, a mixture taking fire in cloſe veſſels.
	Bismuth. A partial ſolution.
	Regulus of Antimony. A partial ſolution.
	Cobalt. A partial ſolution of a red colour.
	Manganese. A partial ſolution in its natural ſtate. When the manganeſe is phlogiſticated, a cryſtallizable ſalt may be obtained.
INFLAMMABLES.	Charcoal. A mixture taking fire and ſubliming when heated in cloſe veſſels.
	Oil of Turpentine, &c. A thick black ſubſtance after ſome days digeſtion.
	Sulphur. A red ſublimate.

ACID of MOLYBDÆNA may be united with the following Subſtances, viz.

ALKALI.	Fixed Vegetable.	A cryſtallizable ſalt.
	Volatile.	A neutral ſalt, the nature of which is unknown.

ACID of MILK may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable.	A deliqueſcent ſalt ſoluble in alcohol.
	Fossile.	A ſalt of a ſimilar nature.
	Volatile.	A deliqueſcent ſalt parting with much of the alkali by heat.
EARTHS.	Calcareous and Argillaceous.	Deliqueſcent ſalts.
	Magnesia.	A ſalt more eaſily cryſtallized, but deliqueſcent.
METALS.	Copper.	A blue ſolution, which cannot be cryſtallized.
	Iron.	A brown ſolution, with the emiſſion of inflammable air, yielding no cryſtals.
	Lead.	An aſtringent ſweetiſh ſolution, which does not cryſtallize.
SEMIMETAL.	Zinc.	A cryſtallizable ſalt, with the emiſſion of inflammable air during the ſolution.

ACID of SUGAR of MILK may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable.	A ſalt very difficult of ſolution.
	Fossile.	A ſalt more eaſily ſoluble.
	Volatile.	A peculiar kind of ammoniac.
EARTHS.	Absorbent and Argillaceous.	Inſoluble ſalts.

ACID of APPLES may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable, Fossile, and Volatile.	Deliqueſcent ſalts.
EARTHS.	Calcareous.	A ſalt difficult of ſolution unleſs the acid prevail.
	Magnesia.	A deliqueſcent ſalt.
	Earth of Alum.	A ſalt very difficult of ſolution.
METAL.	Iron.	A brown ſolution, which does not cryſtallize.
SEMIMETAL.	Zinc.	A fine cryſtallizable ſalt.

ACID of FAT may be combined with the following Subſtances, viz.

ALKALIES.	Fixed, Vegetable, and Fossile.	Neutral ſalts of a particular nature.
	Volatile.	A concrete volatile ſalt.
EARTHS.	Calcareous.	A cryſtallizable ſalt of a brown colour.
	Magnesia. Earth of Alum.	A gummy maſs, which refuſes to cryſtallize.
METALS.	Silver.	A ſolution of the calx.
	Platina.	The calx copiouſly diſſolved, and even the perfect metal attacked by diſtillation to dryneſs.
	Copper.	A green ſolution, which cannot be cryſtallized.
	Iron.	A cryſtallizable ſalt, which does not deliquate.
	Lead.	An aſtringent ſolution of the red calx called *minium*.
	Tin.	A ſolution in ſmall quantity.
	Mercury.	A ſolution by being twice diſtilled from the metal.
SEMIMETALS.	Zinc.	Diſſolved in its metalline ſtate.
	Bismuth.	A ſolution of precipitate.
	Regulus of Antimony.	A cryſtallizable ſalt, which does not deliquate.
	Manganese.	A perfect and clear ſolution.

ACID of BENZOIN may be combined with the following Subſtances, viz.

ALKALIES.	Fixed Vegetable.	A ſalt ſhooting into pointed feathery cryſtals.
	Fossile.	A ſalt procurable in larger cryſtals.
	Volatile.	A deliqueſcent ſalt ſcarce cryſtallizable.
EARTHS.	Calcareous.	A cryſtallizable ſalt not eaſily ſoluble.
	Magnesia.	A cryſtallizable ſalt eaſily ſoluble.

The FIXED ALKALI, whether Vegetable or Fossile, can be united with the following Bodies; but the Vegetable is beſt known.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; and acid of Urine, of Amber, of Ants, of Borax, &c. as in the former part of this Table.

ALKALIES of all ſorts. The uſes of theſe mixtures are not known.

EARTHS.	Crystalline.	*Liquor ſilicum.* By fuſion with twice their weight of alkali. *Glaſs.* By fuſion with a much ſmaller proportion of alkali. This is the compoſition of cryſtal glaſs, and all others commonly uſed.
	Absorbents.	Argillaceous, and all kinds of earths. *Glaſs.* By fuſion; differing in quality according to the nature of the ingredients. Glaſs is likewiſe produced with it in fuſion with metals.
METALS.	Gold*.	After having precipitated it from aqua-regia, it diſſolves it if the alkali has been calcined with animal ſubſtances.
	Silver*.	After having precipitated it from the nitrous acid, it diſſolves it if the alkali has been calcined in contact with the flame.

METALS.	Tin.	A corroded powder. By the ordinary means of ſolution.
	Copper.	By ditto.
	Lead.	A fluid ſolution. By ditto. This ſtains hair black.
	Iron*.	A blood-coloured ſolution. By dropping a ſolution of iron in the nitrous acid, into an alkaline lixivium.
	Mercury*.	A fluid ſolution. After precipitating it from acids; if the alkali is in too large proportions, it then diſſolves it, eſpecially if the alkali has been calcined in contact with the flame.
SEMIMETALS.	Zinc*.	By ſolution, after having precipitated it from the nitrous acid.
	Bismuth*.	By ſolution, after having precipitated it from the nitrous acid.
	Antimony.	*Kermes mineral.* By diſſolving antimony in an alkaline lixivium, filtering, and allowing it to ſtand in a cool place till it precipitates.
		Golden ſulphur of antimony. By diſſolving a crude antimony in an alkaline lixivium, and precipitating by an acid.
		Hepar antimonii. By deflagrating crude antimony with nitre.
		Crocus metallorum. Is hepar antimonii pulveriſed and edulcorated with water.
		Diaphoretic antimony. By deflagrating regulus of antimony with nitre.
		Antimoniated nitre. By diſſolving diaphoretic antimony in water, and allowing it to cryſtallize.
		Magiſtery of antimony. By precipitating a ſolution of diaphoretic antimony by adding vinegar.
		Regulus antimonii medicinalis. By fuſing crude antimony with alkali. This is not properly a compound of alkali and antimony, but of another kind. But as it is a term much uſed, it was proper to explain it.
	Arsenic*.	A metallic arſenical ſalt. By a particular elective attraction from regulus of antimony and nitre.
OILS.	Expressed.	*Soap.* The beſt hard ſoap is made of olive-oil and foſſile alkali. The ordinary white ſoap of this country is made of tallow and potaſh; black ſoap with whale-oil and potaſh.
	Essential.	*Saponaceous maſs.* Beſt made by pouring ſpirit of wine upon cauſtic alkali and then oil, digeſting and ſhaking.
	Empyreumatic.	This mixture diſſolves gold when precipitated from aqua regia; and is the baſis of the fine colour called *Pruſſian blue*; and has various other properties, as yet but little known.
	Fossile.	This has no name, nor are the properties well known; but from ſome obſervations that have been made on native ſoapy waters, it is probable that it would keep linen much longer white than any other kind of ſoap.
SULPHUR.		*Hepar ſulphuris.* By injecting alkalies upon melted ſulphur.
		Lac ſulphuris. By diſſolving ſulphur in an alkaline lixivium, and precipitating by an acid.
WATER.		*Alkaline lixivium,* when cauſtic, or even the ordinary ſolution of mild alkali, is a fluid of great power in waſhing, bleaching, &c.
AIR.	Fixed.	*Mild alkali.* This is the general ſtate in which alkalies are found; but if they are rendered cauſtic by means of quick-lime or otherwiſe, they again abſorb it from the air, or from many other bodies, by elective attraction. When perfectly mild, this alkali may be made to aſſume a cryſtalline form.

The VOLATILE ALKALI, or SPIRIT of *SAL AMMONIAC, can be united with theſe Bodies,* viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; of Urine, of Amber, of Ants, &c.

ALKALI, as above.

METALS.	Gold*.	*Aurum fulminans.* A powder obtained by precipitating it from aqua regia by volatile alkalies.
		A liquid ſolution. By adding a large proportion of alkali after it has been precipitated from aqua regia. This depoſites the gold when long expoſed to the air. The curious vegetation called *arbor Dianæ* is formed by adding mercury to this ſolution. A violently fulminating powder obtained by digeſtion.
	Silver*.	A ſolution. After it has been precipitated from the nitrous acid. A fulminating powder by digeſtion.
	Platina*.	By ſolution, after having precipitated it from aqua regia.
	Copper.	A blue-coloured ſolution. By the ordinary means. This when evaporated to dryneſs, and mixed with tallow, tinges the flame green.
		Sapphire-coloured cryſtals. By cryſtallizing the ſolution.
		Venus fulminans. By evaporating the ſolution to dryneſs.
		Aqua cerulea ſapphirina. By mixing ſal ammoniac, quick-lime, and thin plates of copper, with water, and allowing them to remain a night.
	Iron.	By ordinary ſolution.
	Lead.	By ditto.
	Tin.	The mixts that are produced by theſe metals are little known.
SEMIMETALS.	Bismuth*.	By ſolution, after having precipitated it from the nitrous acid.
	Antimony.	
	Cobalt.	A reddiſh liquor. By ſolution.
	Nickel.	A blue liquor. By ditto.
OILS.	Expressed.	Has no name. By ſolution.
	Essential.	*Sal volatile oleoſum.* By ditto with ſome difficulty, unleſs the alkali is in a cauſtic ſtate.
	Empyreumatic.	A pungent oily ſubſtance, of great power in medicine. The principal one of this kind in uſe is ſpirit of hartſhorn.
	Fossile.	A particular kind of ſoapy ſubſtance.

SULPHUR. Smoking ſpirit of ſulphur. By diſtilling ſal ammoniac, quick-lime, and ſulphur.

ALCOHOL*. By diſtilling alcohol from volatile alkalies, it acquires a cauſtic fiery taſte; but the union is not complete.

WATER. This ſolution might be of uſe in waſhing or bleaching; but, unleſs in particular caſes, would be too expenſive. It coagulates with alcohol.

AIR. Fixed Mild volatile alkali. The uſual ſtate in which it is found; nor has any method yet been diſcovered of rendering it ſolid but in this ſtate.

EXPRESSED OILS may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, as in the foregoing part of this Table.

ALKALIES: Fixed and Volatile, as above.

CALCAREOUS EARTHS. A kind of plaſter. By mixture when in a cauſtic ſtate.

METALS.
- Tin*. Ditto. By ſolution when the tin is in the ſtate of a calx.
- Lead*. Ditto. By boiling the calx of lead in oils. This is uſed for cements in water-works. The common white paint is a mixture of this leſs perfect.

SEMIMETALS. Zinc*. Ditto. By ditto.

OILS: Eſſential, Empyreumatic, and Foſſile. By mixture but their uſes are not much known.

SULPHUR, *Balſam of Sulphur.* By ſolution in a boiling heat.

ALCOHOL. After expreſſed oils are freed from ſoap or plaſters, they are ſoluble in alcohol; but not in their ordinary ſtate.

ESSENTIAL OILS may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, &c. as above.

ALKALIES: Fixed and Volatile, as above.

METALS.
- Copper. By ſolution.
- Lead. By ditto.

OILS of all kinds. By ſolution or mixture.

SULPHUR. A balſam of ſulphur. By ſolution, imperfectly; better by adding eſſential oils to the ſolution made by expreſſed oils or hepar ſulphuris.

ALCOHOL.
- Imperfect mixture. By ſolution.
- Aromatic waters. By diſtillation.

WATER. Diſtilled water of the ſhops. By diſtilling recent vegetable ſubſtances with water.

EMPYREUMATIC OILS may be combined with the following Subſtances, viz.

ACIDS: Vitriolic and Nitrous, as above.

ALKALIES: Fixed and Volatile, as above.

OILS of all kinds. By mixture.

ALCOHOL. By ſolution. By repeated diſtillations the oils are rendered much more ſubtile.

FOSSILE OILS may be combined with the following Subſtances, viz.

ACIDS: Vitriolic and Nitrous, as above.

ALKALIES: Fixed and Volatile, as above.

OILS of all kinds. By mixture.

SULPHUR. With ſome difficulty, by ſolution.

ALCOHOL. - - - By ditto.

SULPHUR may be combined with the following, Subſtances, viz.

ACID*: Vitriolic; with the phenomena above deſcribed.

ALKALIES: Fixed and Volatile, as above.

METALS.
- Silver. A maſs of red-like colour. By adding ſulphur to red-hot ſilver, and fuſing; found alſo with it in the ſtate of an ore.
- Lead. A ſparkling friable maſs, hardly fuſible. By deflagrating ſulphur with lead. This in a native ſtate forms the ore of lead called *galena*.
- Copper. A Black brittle maſs, eaſily fuſed. By adding ſulphur to red-hot copper, or ſtratifying with ſulphur and fuſing. Naturally in ſome yellow pyrites.
- Iron.
  - A ſpungy-like droſs, eaſily fuſible. By putting ſulphur to red-hot iron. This is alſo found naturally in the common yellow or brown pyrites.
  - A fulminating compound. By mixing filings of iron with ſulphur, moiſtening them with water, and preſſing them hard, they in a few hours burſt out into flame. This compoſition has been employed for imitating earthquakes.
  - *Crocus martis.* By deflagrating with iron.
  - *Crocus martis aperiens.* By calcining the crocus martis in the fire till it aſſumes a red appearance.
  - *Crocus martis aſtringens.* By puſhing the heat ſtill forther.
- Tin. A dark-coloured maſs, reſembling antimony. By fuſion.
- Mercury.
  - *Ethiops mineral.* By heating flowers of ſulphur, and pouring the mercury upon it, and ſtirring it well. Its natural ore is called *oinnabar*.
  - *Factitious cinnabar.* By applying the mercury and ſulphur to each other in their pure ſtate, and ſubliming.
  - *Cinnabar of antimony.* By ſubliming corroſive ſublimate and crude antimony; or the reſiduum, after diſtilling butter of antimony.

- SEMIMETALS.
  - Biſmuth. A faint greyiſh maſs, reſembling antimony. By fuſion. If in its metalline ſtate, the ſulphur ſeparates in the cold; but not ſo if the calx has been employed.
  - Antimony. *Crude antimony.* By fuſion.
  - Zinc*. A very brittle, dark-coloured, ſhining ſubſtance. With ſome difficulty, by keeping it long in a moderate fire, and covering it ſeveral times with ſulphur, and keeping it conſtantly ſtirred.
  - Arsenic.
    - *Yellow arſenic.* By fuſing it with $\frac{1}{10}$th its weight of ſulphur.
    - *Red arſenic.* By ditto with $\frac{1}{5}$th its weight of ſulphur.
    - *Ruby of ſulphur*, or arſenic, or golden ſulphur. By ſubliming when the proportions are equal.
    - *Orpiment.* A natural production; not perfectly imitable by art; compoſed of ſulphur and arſenic. Much uſed as a yellow paint.
  - Nickel. A compound; compact and hard as lead; of a bright metallic appearance; internally yellow. By fuſion.

OILS: Expreſſed, Eſſential, and Foſſile, as above.

WATER. *Gas ſylveſtre.* By receiving the fumes of burning ſulphur in water. This ought rather to be called a union of the volatile vitriolic acid with water.

ALCOHOL may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and of Borax, as above.

ALKALI*: Volatile, as above.

METALLIC calces, in ſome particular caſes.

OILS: Expreſſed, Eſſential, Empyreumatic, and Foſſile, as above.

WATER. By ſolution.

GOLD may be combined with the following Subſtances, viz.

ACIDS: Vitriolic*, Nitrous*, and Muriatic*. In the circumſtances and with the phenomena above deſcribed.

ALKALIES: Fixed*, and Volatile*, as above.

- METALS.
  - Silver. By fuſion. And the ſame is to be underſtood of all the combinations of metals, unleſs particularly ſpecified.
  - Platina. Ductile, and of a duſky colour. This has been employed to debaſe gold, as it is of the ſame ſpecific gravity, and is not diſcoverable by the uſual teſts for diſcovering the purity of gold.
  - Lead. A very brittle maſs. Gold is rendered pale by the leaſt admixture with this.
  - Tin. A brittle maſs when the tin is added in conſiderable quantity; but the former accounts of this have been exaggerated.
  - Copper. Paler and harder than pure gold. This mixture is uſed in all our coins, the copper being called the *alloy*.
  - Iron. Silver-coloured, hard and brittle; very eaſily fuſed.
  - Mercury. Soft like a paſte called an *amalgamum.* By ſolution; it being in this caſe called *amalgamation*; and the ſame is to be underſtood of the ſolution of any other metal in quickſilver.
- SEMIMETALS.
  - Zinc. A bright and whitiſh compound, admitting of a fine poliſh, and not ſubject to tarniſh; for which qualities it has been propoſed as proper for analyſing ſpecula for teleſcopes.
  - Arsenic. Brittle; and the gold is thus rendered a little volatile.
  - Antimony. A fine powder for ſtaining glaſs of a red colour. By calcination.
  - Biſmuth*. A brittle whitiſh regulus; volatile in the fire.
  - Cobalt.
  - Nickel. White and brittle.

SILVER may be combined with the following Subſtances, viz.

ACIDS: Vitriolic*, Nitrous*, Muriatic*, Vegetable*, and Acid of Ants*, as above.

ALKALIES: Fixed* and Volatile*, as above.

CRYSTALLINE EARTHS and other vitreous matters. A fine yellow opake glaſs. The fineſt yellow paint for porcelain is procured from glaſs mixed with ſilver.

- METALS.
  - Gold, as above.
  - Platina. Pretty pure and malleable. Difficult of fuſion; and in part ſeparates when cold.
  - Lead. Very brittle.
  - Tin. Extremely brittle, as much ſo as glaſs.
  - Copper. Harder than ſilver alone. Uſed in ſmall proportions as alloy in coins.
  - Iron. A hard whitiſh compound.
  - Mercury*. By amalgamation with ſilver-leaf, or calx of ſilver precipitated by copper, but not by ſalts: This is uſed for ſilverizing on other metals, in the ſame way as the amalgamum of gold.
- SEMIMETALS.
  - Zinc. Hard, ſomewhat malleable, and of a white colour.
  - Antimony. A brittle maſs.
  - Biſmuth. A white ſemi-malleable body.
  - Arſenic. Brittle; the ſilver being rendered in part volatile.
  - Cobalt.

SULPHUR, as above.

LEAD may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Ants, as above.

ALKALIES: Fixed and Volatile, as above.

CRYSTALLINE EARTHS. A thin glaſs. By fuſion in a moderate heat.

METALS.
- GOLD and Silver, as above.
- PLATINA. Of a leafy or fibrous texture, and purpliſh or blue colour when expoſed to the air. If a large proportion of platina is uſed, it ſeparates in the cold.
- TIN. A little harder than either of the metals, and eaſily fuſed: hence it is uſed as a ſolder for lead; and it forms the principal ingredients of pewter. If the fire is long continued, the tin floats on the ſurface.
- Copper*. Brittle and granulated, like tempered iron or ſteel when broke. By throwing pieces of copper into melted lead. The union here is very ſlight.
- IRON*. An opaque browniſh glaſs. By a great degree of heat if the iron has been previouſly reduced to the ſtate of a calx; but never in its metallic ſtate.
- MERCURY*. By amalgamation. Effected only in a melting heat, unleſs ſome biſmuth has been previouſly united with the mercury.

SEMIMETALS.
- ZINC. Hard and brittle. By pouring zinc on melted lead. If the zinc is firſt melted, and the lead injected upon it, it then deflagrates.
- ANTIMONY*.
- BISMUTH. A grey-coloured ſemi-malleable body, eaſily fuſed; and thence uſed as a ſolder for lead or tin.
- ARSENIC.
  - A grey-coloured brittle maſs, eaſily fuſed, and extremely volatile.
  - A hyacinth-coloured glaſs. By fuſion in a conſiderable heat. This glaſs is eaſily fuſed; and is a much more powerful flux than pure glaſs of lead.
- COBALT. The nature of this compound is not known.
- NICKEL. A brittle metallic body.

OILS: Expreſſed* and Eſſential, as above.

SULPHUR, as above.

TIN may be combined with the following Subſtances, viz.

ACIDS: Vitriolic*, Nitrous*, Muriatic, Vegetable*, of Urine, as above.

ALKALIES: Fixed and Volatile, as above.

CRYSTALLINE EARTHS or other vitreous matters. An opaque white vitreous maſs, which forms the baſis of white enamels.

METALS.
- GOLD, Silver, and Lead, as above.
- PLATINA. A coarſe hard metal which tarniſhes in the air.
- COPPER. A brittle maſs. When the copper is in ſmall proportions, it is firmer and harder than pure tin. This, in right proportions with a little zinc, forms bell-metal.
- IRON. A white brittle compound. By heating filings of iron red-hot, and pouring melted tin upon them. A metal reſembling the fineſt ſilver is made of iron, tin, and a certain proportion of arſenic.
- MERCURY. This amalgamum forms foils for mirrors; and forms the yellow pigment called *aurum moſaicum*. By being ſublimed with ſulphur and ſal ammoniac.

SEMIMETALS.
- ZINC. Hard and brittle. When the zinc is in ſmall proportions, it forms a very fine kind of pewter.
- ANTIMONY* *Regulus veneris.* By elective attraction from copper and crude antimony
- BISMUTH. Bright, hard, and ſonorous, when a ſmall proportion of biſmuth is uſed. This is very eaſily fuſed, and employed as a ſolder.
- ARSENIC. A ſubſtance in external appearance reſembling zinc.
- COBALT. By fuſion.
- NICKEL. A brittle metallic maſs.

OIL: Expreſſed*, as above.

SULPHUR, as above.

COPPER may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.

ALKALIES: Fixed, and Volatile, as above.

METALS.
- GOLD, Silver, Lead*, and Tin, as above.
- PLATINA. A white and hard compound, which does not tarniſh ſo ſoon as pure copper, and admits of a fine poliſh.
- IRON. Harder and paler than copper. Eaſily fuſed.
- MERCURY*. A curious amalgam. Soft at firſt, but afterwards brittle. By triturating mercury with verdigris, common ſalt, vinegar, and water.

SEMIMETALS.
- ZINC.
  - *Braſs.* Commonly made by cementation with calamine. The larger the proportion of zinc, the paler, harder, and more brittle is the braſs.
  - *Prince's metal, pinchbeck,* and other metals reſembling gold. By employing zinc in ſubſtance in ſmall proportions. The beſt pinchbeck about 1-4th of zinc.
  - *Spelter.* A native ſubſtance, found in Cornwall, conſiſting of zinc and copper, and uſed as a ſolder.
- ANTIMONY. By fuſion.
- BISMUTH. A paliſh brittle maſs. Somewhat reſembling ſilver.
- ARSENIC. *White copper.* By pouring arſenic, fuſed with nitre, upon copper in fuſion. If too large a proportion of arſenic is uſed, it makes the compound black and apt to tarniſh.
- COBALT. White and brittle.
- NICKEL. White and brittle, and apt to tarniſh.

OILS: Eſſential, as above.

SULPHUR, as above.

IRON may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.

ALKALIES: Fixed*, and Volatile, as above.

VITRESCENT EARTHS. A tranſparent glaſs. In general blackiſh; but ſometimes yellow, green, or blue. The colour is influenced by the degree of heat as well as nature of the ingredients.

METALS.
- Gold, Silver*, Lead*, Tin, and Copper, as above.
- Platina. With caſt iron it forms a compound remarkably hard, ſomewhat ductile, and ſuſceptible of a fine poliſh.

SEMIMETALS.
- Zinc. A white ſubſtance reſembling ſilver.
- Antimony. The magnetic quality of the iron is totally deſtroyed in this compound.
- Bismuth. In a ſtrong heat, this emitteth flames.
- Arsenic. A whitiſh, hard, and brittle compound. By fuſing with ſoap or tartar. A metal reſembling fine ſteel is made by fuſing caſt iron with a little arſenic and glaſs.
- Cobalt. A compound remarkably ductile. By fuſion in a moderate heat.
- Nickel. A brittle maſs.

SULPHUR, as above.

MERCURY may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrious, Muriatic, Vegetable*, of Urine, as above.

ALKALI: Fixed*, as above.

METALS.
- Gold, Silver*, Lead*, Tin, and Copper, as above.
- Platina. The compound reſulting from this mixture is not known.

SEMIMETALS.
- Zinc. An amalgam. Soft or hard, according to the proportions employed.
- Antimony. By melting the regulus, and pouring it upon boiling mercury. By frequently diſtilling from this amalgam, the mercury is rendered much more pure, and then is called *animated mercury*.
- Bismuth. A ſilverizing for iron. By putting this amalgam upon iron, and evaporating the mercury. It has much the appearance of ſilver.
- Cobalt. By mixing firſt with nickel, and then adding mercury.

SULPHUR, as above.

ZINC may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.

METALS.
- Gold, Silver, Lead, Tin, Copper, and Iron, as above.
- Platina A hard ſubſtance.
- Mercury, as above.

SEMIMETALS.
- Antimony. This mixture is applied to no particular uſe.
- Arsenic. A black and friable maſs.
- Cobalt. The particular nature and properties of this mixt is not known.

OIL: Expreſſed*, as above.

SULPHUR*, as above.

ANTIMONY may be combined with the following Subſtances, viz.

ACIDS: Vitriolic*, Nitrous, Vegetable*, and Urinous. With the phenomena, and by the means above deſcribed.

ALKALIES: Fixed and Volatile, as above.

VITREOUS EARTHS. A thin penetrating glaſs; which is a powerful flux of metals.

METALS.
- Gold, Silver, Lead, Tin*, Copper, and Iron, as above.
- Ptatina. A hard maſs.
- Mercury, and Zinc, as above.

SEMIMETALS.
- Bismuth. A maſs reſembling regulus of Antimony.
- Arsenic. The nature and qualities of this mixt are not known.
- Cobalt. Nature unknown.
- Nickel. Ditto.

SULPHUR, as above.

BISMUTH may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and Urinous; with the phenomena, *&c.* above deſcribed.

ALKALIES: Fixed*, and Volatile*, as above.

VITREOUS MATTERS. A yellow glaſs. The ore of Biſmuth affords with theſe a blue glaſs; but this is probably owing to ſome mixture of Cobalt with it.

METALS.
- Gold, Silver, Lead, Tin, Copper, and Iron, as above.
- Platina. This mixture changes its colour much on being expoſed to the air.
- Mercury, as above.

SEMIMETALS.
- Antimony, as above.
- Arsenic. Nature not known
- Cobalt*. By mixing firſt with with nickel or regulus of antimony, and then adding cobalt; but it cannot be united by itſelf.
- Nickel. This mixt is not known.

SULPHUR, as above.

ARSENIC may be combined with the following Subſtances, viz.

ACIDS: Vitriolic, Muriatic*, Vegetable*, and Urinous; with the phenomena, *&c.* abovementioned.

ALKALIES : Fixed, and Volatile ; with the phenomena, and by the means mentioned above.

VITREOUS MATTERS. A glaſs which greatly promotes the fuſion of other ſubſtances. The arſenic muſt firſt be prepared by diſſolving and precipitating from alkalies.

METALS. GOLD, Silver, Lead, Tin, Copper, and Iron, as above.
PLATINA.

SEMIMETALS. ZINC, Antimony, and Biſmuth, as above.
COBALT.
NICKEL. The phenomena attending theſe mixtures have not been as yet particularly obſerved.

SULPHUR, as above.

PLATINA may be combined with the following Subſtances, viz.

ACIDS : Muriatic* ; with the phenomena, *&c.* mentioned above.
ALKALI : Volatile, as above.
METALS : GOLD, Silver, Mercury, Tin, Copper, and Iron, as above.

SEMIMETALS. ZINC, Biſmuth, and Arſenic, as above.
COBALT.
NICKEL. The phenomena attending theſe mixtures not yet obſerved.

COBALT may be combined with the following Subſtances, viz.

ACIDS : Vitriolic, Nitrous, Muriatic, and Urinous ; with the phenomena, *&c.* as above deſcribed.
ALKALI : Volatile, as above.

EARTHS. CALX of FLINT. *Saffre.* By mixing calcined cobalt with calx of flint, and moiſtening them with water, and preſſing them cloſe in wooden tubs.
Smalt. By vitrifying theſe with the addition of a little potaſh.

METALS : GOLD, Silver, Platina, Mercury*, Lead, Tin, Copper, and Iron, as above.

SEMIMETALS. ZINC, Antimony, Biſmuth*, and Arſenic, as above.
NICKEL. The properties of this compound not known.

NICKEL may be combined with the following Subſtances, viz.

ACIDS : Nitrous, and Muriatic ; with the phenomena, *&c.* as mentioned above.
ALKALI : Volatile, as above.
METALS : Gold, Platina, Lead, Tin, Copper, and Iron, as above.
SEMIMETALS : Antimony, Biſmuth, Arſenic, and Cobalt, as above.
SULPHUR, as above.

ABSORBENT EARTHS may be combined with the following Subſtances, viz.

ACIDS : Vitriolic, Nitrous, Muriatic, and Vegetable ; with the phenomena, and by the aſſiſtances abovementioned.
ALKALIES : Fixed as above.

EARTHS. CRYSTALINE. By this mixture they are both much eaſier melted into glaſs than by themſelves, but not without the addition of ſome alkali.
ARGILLACEOUS. This mixture eaſily runs into a glaſs without any addition.

WATER. *Lime-water.* By ſolution. It is ſometimes found flowing out of the earth in ſprings ; and as it always quits the water when expoſed to the air, it is there depoſed on the banks of the ſtreams, forming the ſtony incruſtations called *petrifications* : And filtering through the pores of the earth, and dropping through the roofs of ſubterraneous caves, it forms the curious incruſtations found hanging from the roof of ſuch places ; ſometimes aſſuming forms ſtupenduouſly magnificent.

AIR. FIXT. *Lime-ſtone.* It is from the quality that quick-lime has of abſorbing its air, again with it reſuming its ſtony conſiſtence, that it is fitted for a cement in building ; and the great hardneſs of the cements in old buildings is owing to the air being more perfectly united with theſe than in newer works.

CRYSTALLINE or VITRESCENT EARTHS may be combined with the following Subſtances, viz.

ACIDS : Vitriolic*, and Nitrous* ; with the phenomena, *&c.* as abovementioned.
ALKALI : Fixed, as above.
ABSORBENT EARTHS : as above.
ARGILLACEOUS EARTHS. A maſs running into glaſs in a moderate heat.
METALS : Lead, Tin, Copper, and Iron, as above.
WATER. Although this is not ſoluble in water by any operation that we are acquainted with ; yet, from its cryſtalline form, it is probable that it has been once ſuſpended ; and certainly it is ſo at this day in thoſe petrifying ſprings whoſe incruſtations are of the cryſtalline ſort.
SEMIMETALS : Antimony, Biſmuth, Arſenic, and Cobalt, as above.

ARGILLACEOUS EARTH may be combined with Abſorbent and Cryſtalline Earths, as above. With water it only unites into a paſte of a mechanical nature.

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Some late experiments of Dr Prieſtley, have ſhown, that though nitrous acid is produced from the decompoſition of dephlogiſticated and phlogiſticated air, by taking the electric ſpark in the mixture, it is likewiſe produced by the more rapid decompoſition of combuſtion, when inflammable air is made uſe of inſtead of the phlogiſticated kind. In this caſe, though phlogiſticated air ſhould happen to exiſt in the mixture, it is not in the leaſt affected by the proceſs, but remains after the combuſtion of the others, juſt as it was; nay, the Doctor obſerves, that by the addition of phlogiſticated air, the quantity of nitrous acid produced is ſo far from being augmented, that it is much diminiſhed. The acid in theſe proceſſes always appears to be extremely volatile, inſomuch that ſome part of it conſtantly eſcapes. No liquor at all was condenſed when the exploſions were made in quick ſucceſſion, even though the veſſel never became hotter than the hand. In another proceſs, the atmoſpheric air was perfectly excluded, while the pureſt dephlogiſticated air was produced from one of the materials employed, viz. precipitate *per ſe*. In this experiment he found, that a conſiderable quantity of fixed air was produced, and that the water became acid by the abſorption of it. He concludes, therefore, on the whole, that a mixture of dephlogiſticated and inflammable air always produces an acid by combuſtion; but that, when they are in their naſcent ſtate, the aerial acid is generated; when both are completely formed previous to the experiment, the nitrous acid appears.

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M. Pelletier has now diſcovered a method of uniting phoſphorus, without any decompoſition, with all the metals, though he cautions againſt the danger with which the proceſs is attended. Gold is phoſphorated by mixing half an ounce of its calx with an ounce of phoſphoric glaſs and about a grain of powdered charcoal; the whole is then put into a crucible, the compoſition covered with a little powdered charcoal, and a degree of heat ſufficient to fuſe the gold applied. A great many phoſphoric vapours ariſe, but part are detained, and unite with the gold which is left at the bottom of the crucible. The metal by this operation loſes its colour, becomes whitiſh, breaks under the hammer, and has a cryſtalline appearance. By continuing the fire a long time the phoſphorus would be entirely diſſipated. The quantity of phoſphoric glaſs and charcoal juſt mentioned is ſufficient to phoſphorate a whole ounce of platina. By an hour's calcination in a crucible, the metal is converted into a blackiſh maſs reſembling ſilver, weighing upwards of an ounce, and of which the lower part conſiſts of cubical cryſtals. Notwithſtanding this change, however, the quantity of phoſphorus united with the platina is very inconſiderable; for from 12 ounces of the metal, and as much phoſphoric glaſs, only 12 ounces and five grains of the phoſphorated metallic maſs was obtained. It was very brittle, but of conſiderable hardneſs; was not attracted by the magnet, and by expoſure to a ſtrong fire parted with the phoſphorus it had been combined with. He obſerves, that all the metals loſe their malleability by combination with phoſphorus, excepting tin and lead; and the reſiduum of the matter which has once phoſphorated a metal, will ſerve again for the ſame purpoſe.

The ſalt formed by a combination of the phoſphoric acid with mineral alkali is found to be an uſeful purgative, and as ſuch is now brought into practice.

Meſſrs Struve and Marquart are ſaid to have diſcovered, that the gaſtric juice of animals is compoſed of the phoſphoric acid and volatile alkali; and Mr Struve has compoſed a liquid from theſe two ingredients which acts in a ſimilar manner on alimentary matters.

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The acid procurable from this ſubſtance by means of the nitrous, reſembles that of tartar, in being capable of ſuperſaturating the vegetable alkali, and forming with it an acid ſalt reſembling crude tartar. This is found naturally exiſting in ſorrel and ſome other plants There is, however, another acid obtained from ſugar along with an empyreumatic oil, by dry diſtillation, which has been purified and examined by Mr Schrikel. Eight ounces and four ſcruples of liquid were obtained in this manner from 16 of fine ſugar. About ſix drachms of water came over firſt; after which the acid paſſed in white vapours, which condenſed in unctuous ſtriæ on the ſides of the receiver. It had a pungent and agreeable ſmell, and taſted empyreumatic By repeated diſtillations from pure clay, its ſmell became mild, and it acquired an apparent increaſe of acidity. With vegetable alkali, it formed a ſalt taſting like that of Sylvius, and ſhooting into needle-like cryſtals, ſoluble with difficulty in cold water, but not at all in ſpirit of wine. It did not deliquate in the air; but decrepitated in the fire, and did not melt on hot coals. With the mineral alkali yellow cryſtals were formed reſembling Rochelle ſalt in taſte, eaſily ſoluble in water, and not deliquating in the air. Volatile alkali gave a ſharp ſaline liquor, which could not be cryſtallized, but left a ſaline maſs on evaporation; and a ſimilar ſaline maſs was produced by uniting it with calcareous earth. Magneſia and earth of alum formed gummy compounds. When concentrated, it diſſolved the calx of gold, and even gold-leaf; but had no effect on ſilver, mercury, or their calces With minium, it gave a yellow ſolution, which ſhot into oblong white cryſtals of an aſtringent taſte. A blood-red ſolution, which ſhot into green cryſtals was obtained from iron. Copper was diſſolved into a green liquid, which did not cryſtallize. Regulus of antimony was alſo diſſolved, and the ſolution was of a greeniſh colour. Zinc was partly diſſolved into a green liquor, and partly corroded. The precipitates were remarkable. The cryſtals of iron gave a green precipitate with alkalies, a black or dark blue one with Pruſſian alkali, and a white one with marine acid. Solution of regulus let fall a yellow precipitate with fixed alkali; with volatile alkali, a powder ſoluble again in the precipitant; vitriolic and marine acids, and an infuſion of galls, threw down a white powder, but no precipitate enſued on adding nitrous acid Solution of zinc gave a white precipitate with infuſion of galls, alkalies of all kinds whether fixed, volatile, or phlogiſticated, as well as by the vitriolic acid. Tin was partially diſſolved, and the ſolution precipitated by alkalies, and an infuſion of galls, but not by any of the mineral acids. Lead was precipitated of a white colour by vitriolic and marine acids, and of a grey colour by infuſion of galls.

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Though the acid of tartar has been commonly ſuppoſed a product of the vinous fermentation, yet late experiments have ſhown that this is not the caſe. It has been found not only in the juice of the grape, but in that of tamarinds, the berries of the *rhus coriaria*, and the leaves of the *rumex acetoſa*. In theſe it is generally combined with the vegetable fixed alkali, or with calcareous earth. Hermbſtadt has found it combined with calcareous earth in the juice of the roots of the *triticum repens*, the *leontodon taraxacum*, and *China bark*. By the aſſiſtance of nitrous acid he obtained it alſo from the juice of grapes, mulberries, apples, pears, oranges, ſtrawberries, and plums; alſo from honey, ſugar, gum arabic, manna, ſpirit of wine, beech wood, and the root of black hellebore. In theſe caſes, where the nitrous acid is made uſe of, however, it may juſtly be ſuppoſed that the acid of tartar is partly at leaſt produced from it. In Scheele's proceſs for procuring the pure acid of tartar by means of calcareous earth, it is adviſable to make uſe of quicklime rather than chalk, as by this double the quantity of tartar will be decompoſed. An hundred parts of pure tartar contain about 23 of vegetable alkali, 43 parts of acid employed to ſaturate that alkali, and 34 of ſuperabundant acid. By uſing oyſter-ſhells well prepared by boiling and powdering, the cryſtals of the acid may be obtained very white and pure. Some chemiſts have imagined that the vegetable alkali, does not exiſt ready formed in tartar, but that it is produced by fire or mineral acids. In proof of this M. Marbi offers the following experiments. On an ounce of cream of tartar were poured 10 ounces of boiling water, and the mixture allowed to remain in a jar covered with paper and parchment in which a ſmall hole was made with a pin. At the end of three months it was conſiderably diminiſhed; and contained a quantity of thick, tough, yellow, mucilaginous matter, which neither effervesced with acids nor alkalies, and, when burnt, the aſhes were found to contain only a very ſmall quantity of alkali. The experiment was repeated by Mr Corvinus with ſome variation. He kept a ſolution of cream of tartar in a heat between 10° and 30° of Reaumur's ſcale; removing the ſaline pellicles which formed on the ſurface as faſt as they appeared, and rediſſolving them in water. By continuing the digeſtion for ſeveral months, the liquor became at laſt evidently alkaline: and he thus obtained 216 grains of a brown alkali from two ounces of cream of tartar. Mr Berthollet expoſed for nine months, to the heat of his laboratory, a ſolution of two ounces of cream of tartar in eight ounces of water; taking care to replace the water which evaporated, but without removing the cruſts which formed upon the ſurface. At the end of this time he found that the liquor was no longer acid, but began to turn the ſyrup of violets green. In 18 months it became ſtrongly alkaline; and left, when evaporated, an oily reſiduum which effervesced with acids, and weighed 468 grains. On treating in the ſame manner a ſolution of terra foliata tartari, the liquor began to change the ſyrup of violets green in two months, and in four the decompoſition ſeemed to be complete. At the end of a year he filtered and evaporated the liquor to dryneſs, by which proceſs he obtained 432 grains of fixed alkali. The ſame quantity of terra foliata tartari decompoſed immediately by diſtillation, yielded only 36 grains more of alkali. Solution of ſalt of wood ſorrel ſuffered no decompoſition by a ſimilar treatment for two years. The latter he obſerved to be a much more powerful antiſeptic than tartar; for which reaſon it ſeems to reſiſt decompoſition in a proportionable degree. He ſuppoſes oil to be the principal cauſe of the deſtruction of theſe acids; and the obvious deficiency of oil in the ſaccharine acid, in compariſon with tartar, ſeems to be the cauſe of the want of capacity in it to undergo the decompoſition juſt mentioned. A remarkable circumſtance attends this ſpontaneous decompoſition; viz. that no air is either abſorbed or emitted during the whole proceſs. It is alſo worth notice, that in combining acid of tartar with fixed alkalies, the ſalt ſuperſaturated with acid or cream of tartar is always formed in preference to the other called *ſoluble tartar*. Thus if to a ſaturated ſolution of alkali with cream of tartar we add another of pure tartareous acid, a white ſpongy matter will be precipitated to the bottom; which, on examination, is found to be a true tartar. Any other acid added to the ſolution of tartariſed tartar will in like manner produce a precipitation of tartar, by engaging a part of the alkali with which it was combined; and if the acid of tartar be added to a ſolution of any neutral ſalt containing the vegetable fixed alkali, as vitriolated tartar, ſalt of Sylvius, and nitre, a ſimilar precipitation of tartar will enſue. Hence the acid of tartar may be employed as a teſt to diſcover the preſence of the vegetable fixed alkali, and to diſtinguiſh it from the mineral, which has not that effect. Bergman indeed obſerves, that Rochelle ſalt will do the ſame thing; but it muſt be remembered that this is prepared with crude tartar, which contains a portion of vegetable alkali, and not with the pure acid.

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The following is a liſt of the Vegetables from which the induſtry of the modern chemiſts has procured different acids, with the names of the diſcoverers.

1 *Agave Americana.* The juice exſuding from the calyx of this plant yields acid of tartar and apples. Mr *Hoffman of Weimar.*

2 *Aloes.* Acid of ſugar and apples. Mr *Scheele.*

3 *Apples.* A peculiar acid called by the name of the fruit. By nitrous acid that of tartar is procured. Mr *Scheele* and Mr *Hermbſtadt.*

4 *Barberry.* Acid of apples, and of tartar. By treatment with nitrous acid it yields acid of ſugar. *Scheele* and *Hermbſtadt*.—Hoffman denies that it contains any native acid of tartar. By treating it with ſpirit of wine and mangan eſe he obtained an ether.

5 *Bilberry* (*Vaccinium myrtillus*). Equal parts of the acids of citrons and apples. *Scheele.*

6 *Bramble* (*Rubus chamæmorus*). The ſame with the foregoing. *Scheele.*

7 *Camphor.* A peculiar kind of cryſtallizable acid. *M. Koſegorten.*

8 *Cherries.* Equal parts of acids of citrons and apples. Saccharine acid by treatment with ſpirit of nitre. *Scheele*, *Hermbſtadt*, and *Weſtrumb*.—Hermbſtadt ſays that he found acid of tartar alſo.

9 *Citrons* and *lemons* A particular kind of cryſtallizable acid *Scheele*

10 *Coffee.* The infuſion evaporated and treated with ſpirit of nitre Acids of ſugar and apples. *Scheele.*

11 *Corks.* A yellow acid by repeated abſtractions of ſpirit of nitre. With ſome of the alkalies and earths this acid forms cryſtallizable ſalts which do not deliquate, though others do. That with fixed vegetable alkali forms needle-like cryſtals, ſoluble in water, vitriolic, nitrous, or marine acids, but not in vinegar or ſpirit of wine. Like the ſaccharine acid it has a ſtrong affinity to calcareous earth, which it ſeparates from lime-water, and forms a greyiſh ſaline powder, ſoluble in marine acid, but not in water, nor even in its own acid. It exhibits ſome appearances with metals, which deſerve farther examination. *Brugnatelli*

12 *Cranberry.* (*Vaccinium oxycoccos*). Acid of citrons *Scheele.*

13 *Currants, red* and *white.* Acids of citrons and apples. *Weſtrumb.* Hermbſtadt ſays that they contain acid of tartar.

14 *Elder berries.* Acid of apples *Scheele.*

15 *Galls.* A peculiar kind of acid. *Scheele*—Mr Kier obſerves, that from other aſtringent matters, eſpecially thoſe uſed in dyeing, it is probable that ſimilar acids might be obtained. Mr Morveau has obtained from galls a reſin which he ſuppoſes to be their acidifiable baſe; and which, along with pure air, forms the acid of galls. When purified, this acid is ſaid to make a fine and durable ink.

16 *Geranium acidum.* Small acid cryſtals *Cartheuſer.* Said by Hermbſtadt to be the acid of ſugar.

17 *Gooſeberries.* Acid of apples. *Scheele.*—Hermbſtadt ſays that they contain the acid of tartar alſo.

18 *Grapes.* Their juice well known to contain the acid of tartar partially combined with fixed alkali.

19 *Graſs-roots.* Saline cryſtals from the extract of the juice after three months ſtanding These were ſoluble in water, and gave an earthy precipitate on mixture with fixed alkali. On abſtracting the nitrous acid from them, and adding a ſolution of calcareous earth in vinegar, a precipitate fell, which was found to conſiſt of acid of tartar ſaturated with lime. *Hermbſtadt*

20 *Gum Arabic.* Acid of ſugar and apples. *Scheele*

21 *Gum tragacanth.* Acids of ſugar of milk, apples, and ſugar.

22 *Haw* (*Cratægus aria*). Equal parts of acids of citrons and apples.

23 *Honey.* An acid liquor by diſtillation; and with ſpirit of nitre, the acid of ſugar. The diſtilled acid has been ſaid to diſſolve gold.

24 *Lemons* An acid the ſame with that of citrons.

25 *Leontodon taraxacum.* Acid of tartar by treatment with ſpirit of nitre.

26 *Manna.* Acid of ſugar by treatment with ſpirit of nitre.

27 *Mulberries* Acid of tartar. *Hermbſtadt.* A cryſtallizable acid ſalt by evaporating the juice. *Angelus Sala.*

28 *Oil of olives.* A ſalt which ſublimed and cryſtallized, by repeated and copious abſtractions of the nitrous acid. *Weſtrumb.*

29 *Peruvian bark.* Acid of apples and ſugar, by treating the extract with nitrous acid. *Scheele.*

30 *Prunus ſpinoſa et domeſtica.* Acid of apples. *Scheele.*

31 *Prunus padus.* Acid of citrons. *Scheele*

32 *Poppy.* Acids of ſugar and apples, by treating the juice with nitrous acid. *Scheele*

33 *Raſpberries.* Acids of apples and citrons. *Scheele.* Acid of tartar by ſaturating the juice with chalk, and then ſeparating the earthy baſis by means of vitriolic acid. *Hermbſtadt.*

34 *Rhapontic.* Acid of tartar by cryſtallizing the juice; of ſugar by treating it with nitrous acid. *Lindheim.*

35 *Rhubarb.* Acids of ſugar and apples by treating the infuſion with nitrous acid. If a pound of Indian rhubarb be infuſed in hot water, a powder ſubſides, which by waſhing becomes white, weighing then about nine drachms, and is found to conſiſt of calcareous earth united with the acid of ſugar. *Scheele.*

36 *Ribes cynoſbati.* Acid of citrons or lemons. *Scheele*

37 *Salep.* Acids of ſugar and apples by treatment with nitrous acid. *Scheele.*

38 *Service* (*Sorbus aucuparia*) Acid of apples. *Scheele.*

39 *Solanum dulcamara.* Acid of citrons. *Scheele.*

40 *Sorrel* (*Rumex acetoſa*). Cryſtals of tartar by evaporating and cryſtallizing the juice; and pure acid of tartar by ſaturating the acid with chalk, and then expelling it by means of the vitriolic. *Hermbſtadt.* Other chemiſts, however, have certainly found it to contain the acid of ſugar partly neutralized with alkali, and which is capable of being cryſtallized. This is generally known under the name of *ſalt of wood-ſorrel*, and is manufactured in conſiderable quantities in Thuringia, Suabia, Switzerland, and the Hartz. It is prepared from this plant as well as the *oxalis acetoſella*. The plants are bruiſed in ſtone or wooden mortars; the juice is ſqueezed through linen; and when cleared by ſettling, is to be boiled to a proper conſiſtence, and clarified with the whites of eggs, or with blood. It is to be ſtrained whilſt hot, and then kept in a cold cellar In a few weeks cryſtals will be formed, from which the remaining liquor muſt be poured off, and by further evaporation will yield more ſalt Savary obtained only two ounces, and a half of ſalt from 25 pounds of the juice.

41 *Strawberries.* Equal parts of the acids of apples and citrons. *Scheele.*

42 *Sugar.* See the article.

43 *Sumach* (*Rhus coriaria*). Cryſtals of tartar. Profeſſor *Tromſdorf* and Son

44 *Tamarinds.* Acid of tartar, tartar itſelf, with a mucilaginous and ſaccharine matter. *Weſtrumb.*

45 *Vaccinium vitis idæa.* Acid of citrons. *Scheele.*

46 *Wood and bark of the birch tree.* From 55 ounces of the wood were obtained 17 ounces of rectified acid, which when freed from an amber-coloured oil was to the ſpecific gravity of water as 47 to 48, and of ſuch ſtrength that one ounce of it required 23 of lime-water for its ſaturation. *Chemiſts of Dijon.*—By allowing the acid diſtilled from the bark to remain at reſt for three months, much of its oil was ſeparated; by ſaturation with fixed alkali a dark-coloured neutral ſalt was obtained, which was purified by ſolution and ſubſequent filtration and evaporation. On ſub-

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CHEMNITZ, (Martin) a famous Lutheran divine, the diſciple of Melancthon, was born at Britzen in Brandenburgh, in 1522. He was employed in ſeveral important negociations by the princes of the ſame communion; and died in 1589. His principal work is the Examen of the Council of Trent, in Latin.

CHEMOSH. See Chamos.

CHEMOSIS, a diſeaſe of the eyes, proceeding from an inflammation; wherein the white of the eye ſwells above the black, and overtops it to ſuch a degree, that there appears a ſort of gap between them. Others define it to be an elevation of the membrane which ſurrounds the eye, and is called the *white;* being an affection of the eye, like white-fleſh.

CHENOPODIUM, Gooſe foot, or *Wild Orach:* A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 20th order *Holoraceæ.* The calyx is pentaphyllous and pentagonal; no corolla; one ſeed lenticular, ſuperior. There are 18 ſpecies, 13 of which are natives of Britain. The moſt remarkable are the following: 1. The bonus henricus, or common Engliſh mercury, found growing naturally in ſhady lanes in many places in Britain. It has large triangular, arrow-pointed, entire leaves; upright, thick, ſtriated ſtalks garniſhed with triangular leaves, and terminated by cloſe ſpikes of apetalous yellowiſh-green flowers in June and July, which are ſucceeded by ripe ſeeds in Auguſt. 2. The ſcoparia, belvidere, or annual mock-cypreſs, which is of a beautiful pyramidal form reſembling a young cypreſs tree. 3. The botrys, or oak of Jeruſalem. 4. The ambroſoides, or oak of Cappadocia. All theſe are very eaſily propagated from ſeeds; and will thrive beſt in a rich light earth. Moſt of the ſpecies have an aromatic ſmell. A ſpecies which grows near the Mediterranean is uſed by the Egyptians in ſallads, on account of its ſaltiſh aromatic taſte. From the ſame plant kelp is made in other countries.—The firſt ſpecies, or Engliſh mercury, was formerly uſed as ſpinach; but is now diſuſed, as being greatly inferior to that herb. As an article of the materia medica, it is ranked among the emollient herbs, but rarely made uſe of in practice. The leaves are applied by the common people for healing ſlight wounds, cleanſing old ulcers, and other like purpoſes. The roots are given to ſheep that have a cough. Goats and ſheep are not fond of the herb; cows, horſes, and ſwine, refuſe it.—The ſecond ſpecies, or belvidere, is a plant much eſteemed in China. The following are the properties attributed to it in the Chineſe Herbal. After having ſaid that it is about the end of March or beginning of April that the belvidere ſprings up from the earth; that its ſuckers or ſhoots riſe to the height of eight or nine inches, in ſhape of a child's fiſt half ſhut; that it afterwards extends itſelf, and ſends forth a number of branches loaded with leaves like thoſe of flax; and that, as it grows, its branches arrange themſelves naturally in the form of a beautiful pyramid; it adds, that its leaves, yet tender, abound with juice, and have a very agreeable taſte; that it may be eaten as a ſallad with vinegar, to which a little ginger has been added; that being prepared like other leguminous plants, and baked with meat, it gives it an agreeable and pleaſing flavour: that, when in its full beauty, its leaves become hard and unfit for the table; but that nouriſhment is then found in its root, which ſerves as a reſource in times of famine and ſcarcity. When the belvidere has attained to its natural ſize, the Chineſe ſeparate its principal ſtalk from the reſt, and put it into a ley of aſhes, which cleans and ſoftens it, and frees it from all impurities of the bark. After this bath, it is expoſed to the ſun; and when dry it is baked and ſeaſoned. With regard to the root, which has ſomething of a violet-colour, they ſtrip off the ſkin by filaments, which may be boiled and eaten: but what is particularly ſought after, is the root itſelf; of which, when reduced to powder, they collect only what remains in the bottom of the veſſel, and form it into ſmall loaves that are baked by being held over the ſteam of boiling water. People of a delicate taſte will ſcarcely be tempted to admit this diſh at their tables; but is it not uſeful to point out to the poor peaſants, that in caſes of neceſſity, they may always have recourſe, without danger, to this ruſtic food? In ſuch caſes, they will be indebted to the Chineſe for having made the firſt trial, which, for the moſt part is, dangerous. The Chineſe Herbal cites the example of four mountaineers, who having lived on nothing but the leaves, roots, and ſtalks, of the belvidere, with which their country abounded, had nevertheleſs enjoyed perfect health to a very great age.

CHEPELIO, an iſland in the bay of Panama and province of Darien, in South America, ſituated about three leagues from the city of Panama, which it ſupplies with proviſions. W. Long. 81. N. Lat. 9.

CHEPSTOW, a market town of Monmouthſhire in England, ſeated on the river Wye near its mouth, in W. Long. 2. 40. N. Lat. 51. 40.

CHEQ, or Cherif, the prince of Mecca, who is, as it were, high prieſt of the law, and ſovereign pontiff of all the Mahometans of whatever ſect or country they be. See Caliph.

The grand ſignior, ſophis, moguls, khans of Tartary, &c. ſend him yearly preſents, eſpecially tapeſtry to cover Mahomet's tomb withal, together with a ſumptuous tent for himſelf, and vaſt ſums of money to provide for all the pilgrims during the 17 days of their devotion.

CHERASCO, a ſtrong and conſiderable town of Italy, in Piedmont, and capital of a territory of the ſame name, with a ſtrong citadel, belonging to the king of Sardinia, where he retired in 1706, during the ſiege of Turin. It is ſeated at the confluence of the rivers Sturia and Tanaro, upon a mountain. E. Long. 7. 55. N. Lat. 44. 35.

CHERBURG, a ſea-port town of France, in Normandy, with a harbour and Auguſtine abbey. It is remarkable for the ſea fight between the Engliſh and French fleets in 1692, when the latter were beat, and upwards of twenty of their men of war burnt near Cape la Hogue. The Britiſh landed here in Auguſt 1758, and took the town, with the ſhips in the baſon, demoliſhed the fortifications, and ruined the other works which had been long carried on for enlarging the harbour and rendering it more ſafe and convenient. Within theſe few years it has been attempted again to improve the harbour, and rebuild the works; but after conſiderable progreſs had been made, a great part of them ſuddenly gave way, and the enterpriſe it is thought will not be again reſumed. E. Long 1. 38. N. Lat. 49. 38.

CHEREM, among the Jews, is uſed to ſignify a ſpecies of annihilation. See ANNIHILATION.

The Hebrew word *cherem*, ſignifies properly to *deſtroy*, *exterminate*, *devote*, or *anathematiſe*.

CHEREM is likewiſe ſometimes taken for that which is conſecrated, vowed, or offered to the Lord, ſo that it may no longer be employed in common or profane uſes. No devoted thing that a man ſhall devote unto the Lord, of all that he hath of man and beaſt, and of the field of his poſſeſſion, ſhould be ſold or redeemed; every devoted thing is moſt holy to the Lord: none devoted, which ſhall be devoted of men, ſhall be redeemed, but ſhall ſurely be put to death. There are ſome who aſſert that the perſons thus devoted were put to death; whereof Jephtha's daughter is a memorable example. Judges xi. 29. &c.

CHEREM is alſo uſed for a kind of excommunication in uſe among the Jews. See NIDDUI.

CHERESOUL, or CHAHRZUL, a town of Turkey in Aſia, capital of Curdiſtan, and the ſeat of a beglerbeg. E. Long. 45. 15. N. Lat. 36. 0.

CHERILUS, of Samos, a Greek poet, flouriſhed 479 years before Chriſt. He ſung the victory gained by the Athenians over Xerxes, and was rewarded with a piece of gold for every verſe. His poem had afterwards the honour of being rehearſed yearly with the works of Homer.

CHERLERIA, in botany: a genus of the trigynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 22d order, *Caryophyllea*. The calyx is pentaphyllous; there are five nectaria, bifid, and petal-like; the antheræ alternately barren; the capſule is trilocular and three-valved.

Plate CXXXVIII. CHERLESQUIOR, in Turkiſh affairs, denotes a lieutenant-general of the grand ſignior's armies.

CHERMES, in zoology, a genus of inſects belonging to the order of inſecta hemiptera. The roſtrum is ſituated on the breaſt; the feelers are longer than the thorax; the four wings are deflected; the thorax is gibbous; and the feet are of the jumping kind. There are 17 ſpecies; and the trivial names are taken from the plants which they frequent, as the Chermes graminis, or graſs-bug; the chermes ulmi, or elm-bug, &c. The chermes ficus, or fig-tree bug, one of the largeſt of the genus, is brown above and greeniſh beneath. The antennæ, likewiſe brown, are large, hairy, and one third longer than the thorax. The feet are yellowiſh; the wings large, twice the length of the abdomen. They are placed ſo as to form together an acute roof. The membrane of which they conſiſt is thin and very tranſparent; but they have brown veins, ſtrongly marked, eſpecially towards the extremity. The roſtrum of this chermes is black, and takes its riſe from the lower part of the thorax, between the firſt and ſecond pair of feet. It is an inſect to be met with in great numbers upon the fig tree. The larva has ſix feet. It is like the inſect, when provided with wings. Its form is oblong, and its motion ſlow.

The chryſalis differs from it by two flat buds that ſpring from the thorax and incloſe the wings, afterwards ſeen in the perfect inſect. Theſe chryſalids are frequently met with on plants; and the two plates of their thorax give them a broad uncouth appearance and a heavy look. When the little chryſalids are going to be metamorphoſed, they remain motionleſs under ſome leaves which they fix themſelves upon. Their ſkin then divides upon the head and thorax, and the perfect inſect comes forth with his wings, leaving the ſpoil of his chryſalis open and rent anteriorly upon the leaf. Theſe kind of ſloughs are often found beneath the leaves of the fig-tree. The perfect inſect is furniſhed with four wings, large in proportion to its body, veined, and placed in the form of a roof; and with them it flies. It has, moreover, the faculty of leaping pretty briſkly, by means of its hinder-legs, which play like a ſpring. When it is attempted to catch the chermes, it makes its eſcape rather by leaping than flying. Some of thoſe inſects have a manœuvre worthy of notice. Several ſpecies are provided at the extremity of their body with a ſmall ſharp-pointed implement, but which lies concealed, and that they draw out in order to depoſit their eggs, by making a puncture in the plant that ſuits them. By this method the fir-tree chermes produces that enormous ſcaly protuberance that is to be found at the ſummit of the branches of that tree, and which is formed by the extravaſation of the juices occaſioned by the punctures. The young larvæ ſhelter themſelves in cells contained in the tumor. The white down, under which the larva of the pine-chermes is found, ſeems to be produced much in the ſame manner. That of the box-tree chermes produces no tubercula like thoſe; but its punctures make the leaves of that tree bend and grow hollow in the ſhape of a cap, which by the union of thoſe inflected leaves produces at the extremity of the branches a kind of knobs, in which the larvæ of that inſect find ſhelter. The box-chermes, as well as ſome others, has yet another peculiarity, which is, that the larva and its chryſalis eject at the anus a white ſweet-taſted matter, that ſoftens under the touch, and is not unlike manna. This ſubſtance is found in ſmall white grains within the balls formed by the box-leaves, and a ſtring of the ſame matter is often ſeen depending from the anus of the inſect.

Chermes Mineral. See KERMES.

CHERRY-ISLAND, an iſland in the northern ocean, lying between Norway and Greenland, in E. Long. 20. 5. N. Lat. 75. 0.

Cherry-Tree, in botany. See PRUNUS.

CHERSO, an iſland in the gulph of Venice, with a town of the ſame name near Croatia, belonging to the Venetians. The air is good, but the ſoil ſtony; however, it abounds in wine, cattle, oil, and excellent honey. E. Long. 15. 5. N. Lat. 45. 8.

CHERSONESUS, among modern geographers, the ſame with a peninſula; or a continent almoſt encompaſſed round with the ſea, only joining to the main land by a narrow neck or iſthmus. The words is Greek, χερσονησος; of χερσος, *land*, and νησος, *iſland*; which ſignifies the ſame. In ancient geography, it was applied to ſeveral peninſulas; as the Cherſoneſus Aurea, Cimbrica, Taurica, and Thracia, now thought to be Malacca, Jutland, Crim Tartary, and Romania.

CHERT, PETROSILEX, *Lapis Corneus*, the *Hornſtein* of the Germans; a ſpecies of ſtone claſſed by Cronſtedt among the ſiliceous earths. It is of a coarſer texture than the common flint, as well as ſofter; for which reaſons it is not capable of ſuch a fine poliſh. It is ſemitranſparent at the edges, or when broken into very thin pieces. It is found of different colours, *viz.* white, whitiſh yellow, fleſh-coloured, and greeniſh. According to Mr Kirwan, it runs in veins through rocks, from whence its name is derived; its ſpecific gravity being from 2590 to 2700. In the fire it whitens and decrepitates like ſilex, but is generally fuſible *per ſe*. Mineral alkali does not totally diſſolve it in the dry way, but borax and microcoſmic ſalt do ſo without efferveſcence. Its appearance is duller and leſs tranſparent than common flint. The reddiſh petroſilex, uſed in the count de Lauragais's porcelain manufactory, and there called *feld-ſpat*, contained 72 *per cent.* of ſilex, 22 of argill, and 6 of calcareous earth.

Cronſtedt obſerves that there are not as yet any certain characters known by which the cherts and jaſpers may be diſtinguiſhed from one another, though they can eaſily be ſo by ſight; the cherts appearing of a fine ſparkling texture when broken; but the jaſper being grained, dull, and opaque, and having the appearance of a dry clay. The chert is alſo found forming larger or ſmaller veins, or in nodules like kernels in rocks; whereas the jaſper, on the contrary, ſometimes conſtitutes the principal part of the higheſt and moſt extended mountains. The chert is likewiſe found plentifully in the neighbourhood of ſcaly limeſtone, as flints are in the ſtrata of chalk.

The connection between theſe bodies is not yet diſcovered; but it is impoſſible to eſtabliſh any eſſential difference between them, from the circumſtance of flints and agates being generally found in ſingle, looſe, and irregular nodules, and hardly in rocks like the chert: for near Conſtantinople the agate ſtone runs in a vein acroſs the rock, of the ſame hardneſs, and as fine and tranſparent, as thoſe agates found in round nodules at Deux Ponts

CHERTZEY, a market town of Surrey in England, about ſeven miles weſt from Kingſton upon Thames. W. Long. 30′. N. Lat. 51. 25.

CHERUB, (plural, CHERUBIM); a celeſtial ſpirit, which in the hierarchy is placed next to the ſeraphim. See HIERARCHY.

The term *cherub*, in Hebrew, is ſometimes taken for a calf or ox. Ezekiel ſets down the face of a cherub as ſynonymous to the face of an ox. The word *cherub*, in Syriac and Chaldee, ſignifies to *till* or *plow*, which is the proper work of oxen. Cherub alſo ſignifies *ſtrong* and *powerful*. Grotius ſays, that the Cherubim were figures much like that of a calf. Bochart thinks likewiſe, that the cherubim were more like to the figure of an ox than to any thing beſides; and Spencer is of the ſame opinion. Laſtly, St John, in the Revelations, calls cherubim *beaſts*. Joſephus ſays the cherubim were extraordinary creatures of a figure unknown to mankind. Clemens of Alexandria believes, that the Egyptians imitated the cherubim of the Hebrews in the repreſentations of their ſphinxes and their hieroglyphical animals. All the ſeveral deſcriptions which the ſcripture gives us of cherubim differ from one another; but all agree in repreſenting them as a figure compoſed of various creatures, as a man, an ox, an eagle, and a lion. Such were the cherubim deſcribed by Ezekiel. Thoſe which Iſaiah ſaw, and are called *ſeraphim* by him, had the figure of a man with ſix wings; with two whereof they covered their faces, with two more they covered their feet, and with the two others they flew. Thoſe which Solomon placed in the temple of Jeruſalem are ſuppoſed to have been nearly of the ſame form. Thoſe which St John deſcribes in the Revelations were all eyes before and behind, and had each ſix wings. The firſt was in the form of a lion, the ſecond in that of a calf, the third of a man, and the fourth of an eagle. The figure of the cherubim was not always uniform, ſince they are differently deſcribed in the ſhapes of men, eagles, oxen, lions, and in a compoſition of all theſe figures put together. Moſes likewiſe calls theſe ſymbolical or hieroglyphical repreſentations, which were embroidered on the veils of the tabernacle, *cherubim* of coſtly work. Such were the ſymbolical figures which the Egyptians placed at the gates of their temples and the images of the generality of their gods, which were commonly nothing but ſtatues compoſed of men and animals.

CHERVIL, in botany. See CHÆROPHYLLUM.

CHESAPEAK, in America, one of the largeſt bays in the known world. Its entrance is between Cape Charles and Cape Henry in Virginia, 12 miles wide; and it extends 270 miles to the northward, dividing Virginia and Maryland. Through this extent it is from 7 to 18 miles broad, and generally about 9 fathoms deep; affording many commodious harbours, and a ſafe and eaſy navigation. It receives the waters of the Suſquehannah, Patomack, Rappahannock, York, and James rivers, which are all large and navigable.

CHESELDEN (William), an eminent anatomiſt and ſurgeon, was born at Burrow on the Hill, in the county of Leiceſter, England, deſcended from an ancient family in the county of Rutland, whoſe arms and pedigree are in Wright's “Hiſtory of Rutland.” He received the rudiments of his profeſſional ſkill at Leiceſter; and married Deborah Knight, a citizen's daughter, by whom he had one daughter, Williamina Deborah. In 1713 he publiſhed his Anatomy of the Human Body, one volume, 8vo; and in 1723, A Treatiſe on the High Operation for the Stone. He was one of the earlieſt of his profeſſion who contributed by his writings to raiſe it to its preſent eminence. In the beginning of 1736, he was thus honourably mentioned by Mr Pope: “As ſoon as I had ſent my laſt letter, I received a moſt kind one from you, expreſſing great pain for my late illneſs at Mr Cheſelden's. I conclude you was eaſed of that friendly apprehenſion in a few days after you had diſpatched your's, for mine muſt have reached you then. I wondered a little at your quære, Who Cheſelden was? It ſhows that the trueſt merit does not travel ſo far any way as on the wings of poetry: he is the moſt noted and moſt deſerving man in the whole profeſſion of chirurgery; and has ſaved the lives of thouſands by his manner of cutting for the ſtone.” He appears to have been on terms of the moſt intimate friendſhip with Mr Pope, who frequently in his Letters to Mr Richardſon, talks of dining with Mr Cheſelden, who then lived in or near Queen Square. In February 1737, Mr Cheſelden was appointed ſurgeon to Chelſea hoſpital. As a governor of the Foundling Hoſpital, he ſent a benefaction of 50 l. to that charity, May 7, 1751, incloſed in a paper with the following lines:

> 'Tis what the happy to th' unhappy owe;
> For what man gives, the gods by him beſtow. Pope.

He died at Bath, April 11, 1752, of a diſorder ariſing from drinking ale after eating hot buns. Finding himſelf uneaſy, he ſent for a phyſician, who adviſed vomiting immediately; and if the advice had been taken, it was thought his life might have been ſaved. By his direction, he was buried at Chelſea.

CHESHIRE, a maritime county of England, bounded by Lancaſhire on the north; Shropſhire and part of Flintſhire, on the ſouth; Derbyſhire and Staffordſhire, on the eaſt and ſouth-eaſt; and Denbighſhire and part of Flintſhire, on the weſt and north-weſt. It extends in length about 44 miles, in breadth 25; and is ſuppoſed to contain 125,000 inhabitants. Both the air and ſoil in general are good. In many places of the country are peat-moſſes, in which are often found trunks of fir-trees, ſometimes ſeveral feet under ground, that are uſed by the inhabitants both for fuel and candles. Here alſo are many lakes and pools well ſtored with fiſh: beſides the rivers Merſee, Weaver, and Dee, which laſt falls into a creek of the Iriſh ſea near Cheſter. This county alſo abounds with wood: but what it is chiefly remarkable for, is its cheeſe, which has a peculiar flavour, generally thought not to be inferior to any in Europe; (ſee Cheese). The principal towns are, Cheſter the capital, Cholmondely, Namptwitch, &c.

William the Conqueror erected this county into a palatinate, or county-palatine, in favour of his nephew Hugh Lupus, to whom he granted the ſame ſovereignty and juriſdiction in it that he himſelf had in the reſt of the iſland. By virtue of this grant, the town of Cheſter enjoyed ſovereign juriſdiction within its own precincts; and that in ſo high a degree, that the earls held parliaments, conſiſting of their barons and tenants, which were not bound by the acts of the Engliſh parliament: but this exorbitant power of the palatinates was at laſt reduced by Henry VIII.; however, all caſes and crimes, except thoſe of error, foreign-plea, foreign voucher, and high-treaſon, are ſtill heard and determined within the ſhire. The earls were anciently ſuperiors of the whole county, and all the landholders were mediately or immediately their vaſſals, and under the like ſovereign allegiance to them as they were to the kings of England; but the earldom was united to the crown by Edward III. ſince which time, the eldeſt ſons of kings of England have always been earls of Cheſter, as well as princes of Wales. Cheſhire ſends four members to parliament; two for the county, and two for the capital.

CHESNE (Andrew du), ſtyled the father of French hiſtory, was born in 1584. He wrote, 1. A hiſtory of the popes. 2. An hiſtory of England. 3. An inquiry into the antiquities of the towns of France. 4. An hiſtory of the cardinals. 5. A bibliotheca of the authors who have written the hiſtory and topography of France, &c. He was cruſhed to death by a cart, in going from Paris to his country-houſe at Verriere, in 1640.

CHESNUT-tree. See Fagus.

CHESS, an ingenious game performed with different pieces of wood, on a board divided into 64 ſquares or houſes; in which chance has ſo ſmall a ſhare, that it may be doubted whether a perſon ever loſt a game but by his own fault.

Each gameſter has eight dignified pieces, *viz.* a king, a queen, two biſhops, two knights, and two rooks, alſo eight pawns: all which, for diſtinction's ſake, are painted of two different colours, as white and black.

As to their diſpoſition on the board, the white king is to be placed on the fourth black houſe from the corner of the board, in the firſt and lower rank; and the black king is to be placed on the fourth white houſe on the oppoſite, or adverſary's end of the board. The queens are to be placed next to the kings, on houſes of their own colour. Next to the king and queen, on each hand, place the two biſhops; next to them, the two knights; and laſt of all, on the corners of the board, the two rooks. As to the pawns, they are placed, without diſtinction, on the ſecond rank of the houſe, one before each of the dignified pieces.

Having thus diſpoſed the men, the onſet is commonly begun by the pawns, which march ſtraight forward in their own file, one houſe at a time, except the firſt move, when it can advance two houſes, but never moves backwards: the manner of their taking the adverſary's men is ſide-ways, in the next houſe forwards; where having captivated the enemy, they move forward as before. The rook goes forward or croſs-ways through the whole file, and back again. The knight ſkips backward and forward to the next houſe, ſave one, of a different colour, with a ſidling march, or a ſlope, and thus kills his enemies that fall in his way, or guards his friends that may be expoſed on that ſide. The biſhop walks always in the ſame colour of the field that he is placed in at firſt, forward and backward, aſlope, or diagonally, as far as he liſts. The queen's walk is more univerſal, as ſhe takes all the ſteps of the before mentioned pieces, excepting that of the knight; and as to the king's motion, it is one houſe at a time, and that, either forward, backward, ſloping, or ſide-ways.

As to the value of the different pieces, next to the king is the queen, after her the rooks, then the biſhops, and laſt of the dignified pieces comes the knight. The difference of the worth of pawns, is not ſo great as that of noblemen; only, it muſt be obſerved, that the king's biſhop's pawn is the beſt in the field, and therefore the ſkilful gameſter will be careful of him. It ought alſo to be obſerved, that whereas any man may be taken, when he falls within the reach of any of the adverſary's pieces, it is otherwiſe with the king, who, in ſuch a caſe, is only to be ſaluted with the word *check*, warning him of his danger, out of which it is abſolutely neceſſary that he move; and, if it ſo happen that he cannot move without expoſing himſelf to the like inconveniency, it is check-mate, and the game is loſt. The rules of the game are,

1. In order to begin the game, the pawns muſt be moved before the pieces, and afterwards the pieces muſt be brought out to ſupport them. The king's, queen's and biſhop's pawns, ſhould be moved firſt, that the game may be well opened; the pieces muſt not be played out early in the game, becauſe the player may thereby

loſe his moves: but above all, the game ſhould be well arranged before the queen is played out. Uſeleſs checks ſhould alſo be avoided, unleſs ſome advantage is to be gained by them, becauſe the move may be loſt, if the adverſary can either take or drive the piece away.

2. If the game is crowded, the player will meet with obſtructions in moving his pieces; for which reaſon he ſhould exchange pieces or pawns, and caſtle (A) his king as ſoon as it is convenient, endeavouring at the ſame time to crowd the adverſary's game, which may be done by attacking his pieces with the pawns, if the adverſary ſhould move his pieces out too ſoon.

3. The men ſhould be ſo guarded by one another, that if a man ſhould be loſt, the player may have it in his power to take one of the adverſary's in return; and if he can take a ſuperior piece in lieu of that which he loſt, it would be an advantage, and diſtreſs the adverſary.

4. The adverſary's king ſhould never be attacked without a force ſufficient; and if the player's king ſhould be attacked without having it in his power to attack the adverſary's, he ſhould offer to make an exchange of pieces, which may cauſe the adverſary to loſe a move.

5. The board ſhould be looked over with attention, and the men reconnoitred, ſo as to be aware of any ſtroke that the adverſary might attempt in conſequence of his laſt move. If, by counting as many moves forward as poſſible, the player has a proſpect of ſucceſs, he ſhould not fail doing it, and even ſacrifice a piece or two to accompliſh his end.

6. No man ſhould be played till the board is thoroughly examined, that the player might defend himſelf againſt any move the adverſary has in view; neither ſhould any attack be made till the conſequences of the adverſary's next move are conſidered; and when an attack may with ſafety be made, it ſhould be purſued without catching at any bait that might be thrown out in order for the adverſary to gain a move, and thereby cauſe the deſign to miſcarry.

7. The queen ſhould never ſtand in ſuch a manner before the king, that the adverſary, by bringing a rook or biſhop, could check the king if ſhe were not there; as it might be the loſs of the queen.

8. The adverſary's knight ſhould never be ſuffered to check the king and queen, or king and rook, or queen and rook, or the two rooks at the ſame time; eſpecially if the knight is properly guarded: becauſe, in the two firſt caſes, the king being forced to go out of check, the queen or the rook muſt be loſt; and in the two laſt caſes a rook muſt be loſt at leaſt for a worſe piece.

9. The player ſhould take care that no guarded pawn of the adverſary's fork two of his pieces.

10. As ſoon as the kings have caſtled on different ſides of the board, the pawns on that ſide of the board ſhould be advanced upon the adverſary's king, and the pieces, eſpecially the queen and rook, ſhould be brought to ſupport them; and the three pawns belonging to the king that is caſtled muſt not be moved.

11. The more moves a player can have as it were in ambuſcade, the better; that is to ſay, the queen, biſhop, or rook, is to be placed behind a pawn or a piece, in ſuch a poſition as that upon playing that pawn or piece a check is diſcovered upon the adverſary's king, by which means a piece or ſome advantage is often gained.

12. An inferior piece ſhould never be guarded with a ſuperior, when a pawn would anſwer the ſame purpoſe; for this reaſon, the ſuperior piece may remain out of play; neither ſhould a pawn be guarded with a piece when a pawn would do as well.

13. A well ſupported pawn that is paſſed often coſts the adverſary a piece; and when a pawn or any other advantage is gained without endangering the loſs of the move, the player ſhould make as frequent exchanges of pieces as he can. The advantage of a paſſed pawn is this: for example, if the player and his adverſary have each three pawns upon the board, and no piece, and the player has one of his pawns on one ſide of the board, and the other two on the other ſide, and the adverſary's three pawns are oppoſite to the player's two pawns, he ſhould march with his king as ſoon as he can, and take the adverſary's pawns: If the adverſary goes with his king to ſupport them, the player ſhould go on to queen with his ſingle pawns; and then if the adverſary goes to hinder him, he ſhould take the adverſary's pawns, and move the others to queen (B).

14. When the game is near finiſhed, each party having only three or four pawns on each ſide of the board, the kings muſt endeavour to gain the move in order to win the game. For inſtance, when the player brings his king oppoſite to the adverſary's with only one ſquare between, he will gain the move.

15. If the adverſary has his king and one pawn on the board, and the player has only his king, he cannot loſe the game, provided he brings his king oppoſite to the adverſary's, when the adverſary is directly before or on one ſide of his pawn, and there is only one ſquare between the kings.

16. If the adverſary has a biſhop and one pawn on the rook's line, and this biſhop is not of the colour that commands the corner ſquare the pawn is going to, and the player has only his king, if he can get into that corner, he cannot loſe; but, on the contrary, may win by a ſtale (C).

17. If the player has greatly the diſadvantage of the game, having only his queen left in play, and his king happens to be in a poſition to win, as abovementioned, he ſhould keep giving check to the adverſary's king, always taking care not to check him where he can interpoſe any of his pieces that make the ſtale; by ſo doing he will at laſt force the adverſary to take his queen, and then he will win the game by being in a ſtale-mate.

18. The

(A) *Caſtle his king*, is to cover the king with a caſtle; which is done by a certain move which each player has a right to whenever he thinks proper.

(B) *To queen*, is to make a queen; that is, to move a pawn into the adverſary's back row, which is the rule at this game when the original one is loſt.

(C) When the king is blocked up ſo as to have no move at all.

18. The player ſhould never cover a check with a piece that a pawn puſhed upon it may take, for fear of getting only the pawn in exchange for the piece.

19. A player ſhould never crowd his adverſary up with peices, for fear of giving a ſtale-mate inadvertently, but always ſhould leave room for his king to move.

By way of corroborating what has been already ſaid with reſpect to this game, it is neceſſary to warn a player againſt playing a timid game. He ſhould never be too much afraid of loſing a rook for an inferior piece; becauſe although a rook is a better piece than any other except the queen, it ſeldom comes into play to be of any great uſe till at the end of the game; for which reaſon it is often better to have an inferior piece in play, than a ſuperior one to ſtand ſtill, or moving to no great purpoſe. If a piece is moved, and is immediately drove away by a pawn, it may be reckoned a bad move, becauſe the adverſary gains a double advantage over the player, in advancing at the ſame time the other is made to retire; although the firſt move may not ſeem of conſequence between equal players, yet a move or two more loſt after the firſt makes the game ſcarcely to be recovered.

There never wants for a variety at this game, provided the pieces have been brought out regular; but if otherwiſe, it often happens that a player has ſcarce any thing to play.

Many indifferent players think nothing of the pawns, whereas three pawns together are ſtrong; but four, which conſtitute a ſquare, with the aſſiſtance of other pieces, well managed, make an invincible ſtrength, and in all probability may produce a queen when very much wanted. It is true, that two pawns with a ſpace between are no better than one; and if there ſhould be three over each other in a line, the game cannot be in a worſe way. This ſhows that the pawns are of great conſequence, provided they are kept cloſe together.

Some middling players are very apt to riſk loſing the game in order to recover a piece: this is a miſtake; for it is much better to give up a piece and attack the enemy in another quarter; by ſo doing, the player has a chance of ſnatching a pawn or two from, or gaining ſome advantage over, the adverſary, whilſt his attention is taken up in purſuing this piece.

If the queen and another piece are attacked at the ſame time, and that by removing the queen the piece muſt be loſt; provided two pieces can be gained in exchange for the queen, the queen ſhould be given up, it being the difference of three pieces, and conſequently more than the value of the queen. By loſing the queen, the game is not thrown into that diſorder which it would otherwiſe have been: in this caſe it would be judicious to give the queen for even a piece, or a pawn or two; it being well known among good players, that he who begins the attack, and cannot maintain it, being obliged to retire, generally loſes the game.

A player ſhould never be fond of changing without reaſon, becauſe the adverſary, if he is a good player, will ruin his ſituation, and gain a conſiderable advantage over him. But rather than loſe a move, when a player is ſtronger than the adverſary, it is good play to change, for he thereby increaſes his ſtrength.

When the game is almoſt drawn to a concluſion, the player ſhould recollect that his king is a capital piece, and conſequently ſhould keep him in motion; by ſo doing he generally gets the move, and often the game.

As the queen, rook, and biſhop, operate at a diſtance, it is not always neceſſary in the attack to have them near the adverſary's king.

If a man can be taken with different pieces, the player ſhould take his time, and conſider which of thoſe pieces is the beſt to take it with.

If a piece can be taken almoſt at any time, the player ſhould not be in a hurry about it, but try to make a good move elſewhere before he takes it.

A player ſhould be cautious how he takes his adverſary's pawn with his king, as it often happens to be a ſafe-guard to it.

After all that has been ſaid, it is ſtill neceſſary for us to adviſe thoſe who would play well at this game, to be very cool and attentive to the matter in queſtion: for it is impoſſible that any perſon in the univerſe can be capable of playing at cheſs if their thoughts are employed elſewhere. The laws at this game are,

1. If a player touches his man, he muſt play it, and if he quits it, he cannot recal it.

2. If by miſtake or otherwiſe a falſe move is played, and the adverſary takes no notice of it till he hath played his next move, it cannot be recalled by either of the parties.

3. If a player miſplaces the men, and he plays two moves, it is at the option of the adverſary to permit him to begin the game or not.

4. If the adverſary plays or diſcovers a check to a player's king, and gives no notice of it, the player may let him ſtand ſtill till he does.

5. After the king is moved, a player cannot caſtle.

Saraſin has an expreſs treatiſe on the different opinions of the original of the Latin *ſchacchi*, whence the French *echecs*, and our *cheſs*, is formed. Menage is alſo very full on the ſame head. Leunclavius take it to come from *Uſcoches*, famous Turkiſh robbers: P. Sirmond, from the German *ſcachbe*, "theft;" and that from *calculus*. He takes *cheſs* to be the ſame with the *ludus latrunculorum* of the Romans, but miſtakenly. This opinion is countenanced by Voſſius and Salmaſius, who derive the word from *calculus*, as uſed for *latrunculus*. G. Toloſanus derives it from the Hebrew *ſcach, vallavit et mat mortuus*; whence *check* and *check-mate*. Fabricius ſays, a celebrated Perſian aſtronomer, one Schatrenſcha, invented the game of *cheſs*; and gave it his own name, which it ſtill bears in that country. Nicod derives it from *ſcheque*, or *xeque*, a Mooriſh word for lord, king, and prince. Bochart adds, that *ſcach* is originally Perſian; and that *ſcach-mat*, in that language, ſignifies the king is dead.—The opinion of Nicod and Bochart, which is likewiſe that of Scriverius, appears the moſt probable.

Mr Twiſs mentions a ſmall treatiſe on cheſs, written, as he ſuppoſes, about 400 years ago; at the end of which is a repreſentation of a round cheſs-board, with directions for placing the men upon it. In this the knight can cover the 64 ſquares on the board at as many moves. The board is divided into theſe 64 parts by four concentric circles, having an empty ſpace in the middle; and each of theſe is divided into 16 parts. Number 1 is placed in the outermoſt circle; number 2 in the third circle counting inwards, in the diviſion to the right hand of the former; number 3 is placed in the outermoſt circle, in the diviſion to the right hand of 2; 4 in the third circle counting inwards to the right hand of three; and thus alternately from the firſt to the third, and from the third to the firſt circle, till the round is completed by 16 on the third circle to the left hand of 1. Number 17 is then placed on the diviſion of the innermoſt circle to the right hand of 1; 18 on the ſecond circle counting inwards, to the right hand of 17; and thus alternately from the fourth to the ſecond, and from the ſecond to the fourth circles, until the round is completed by 32, directly below number 1. Number 33 then is placed on the third circle directly to the right hand of number 2; 34 on the fourth circle, to the right hand of 4; and thus alternately between the third and fourth circles, until the round is again completed by 48 on the fourth circle, directly below number 33. The numbers are now placed in a retrograde faſhion; 50 on the outer circle in that diviſion immediately to the right hand of 1; 51 on the third circle, to the left hand of 2, and directly below number 32; 52 is then placed on the outer circle, immediately on the left hand of 1: 53 on the third circle directly to the left hand of 16; and thus alternately on the firſt and third circles, until the laſt round is completed by 64 between the numbers 3 and 5. On this round cheſs-board, ſuppoſing the black king to be placed in number 48 on the fourth circle, the queen ſtands on number 17 at his left hand; the biſhops in 33 and 2; the knights 18 and 47; the caſtles in 3 and 50; the pawns on 19, 4, 49, 64, and 46, 51 32, 1. The white king will then ſtand in 25, oppoſite the black queen; the white queen in 40 oppoſite to the black king, and ſo on. In playing on a board of this kind, it will be found that the power of the caſtle is double to that in the common game, and that of the biſhop only one half; the former having 16 ſquares to range in, and the laſt only four. The king can caſtle only one way; and it is very difficult to bring the game to a concluſion.

With regard to the origin of the game at cheſs, we are much in the dark. Though it came to us from the Saracens, it is by no means probable that they were the original inventors of it. According to ſome it was invented by the celebrated Grecian hero Diomedes. Others ſay, that two Grecian brothers, Ledo and Tyrrheno, were the inventors; and that being much preſſed with hunger, they ſough to alleviate the pain by this amuſement. It is certain, however, that it is a game of very ancient ſtanding, and in former ages has been very faſhionable in every part of Europe; though in this country it is not very common, probably on account of the intenſe application of thought required to play at it. It has long been a favourite of the Icelanders and other northern people. There is little difference between their game and ours.

The game of cheſs has been generally practiſed by the greateſt warriors and generals; and ſome have even ſuppoſed that it was neceſſary for a military man to be well ſkilled in this game. It is a game which has ſomething in it peculiarly intereſting. We read that Tamerlane was a great cheſs-player, and was engaged in a game during the very time of the deciſive battle with Bajazet the Turkiſh emperor, who was defeated and taken priſoner. It is alſo related of Al Amin the khalif of Bagdad, that he was engaged at cheſs with his freedman Kuthar at the time when Al Mamun's forces were carrying on the ſiege of that city with ſo much vigour that it was on the point of being carried by aſſault. Dr Hyde quotes an Arabic hiſtory of the Saracens, in which the khalif is ſaid to have cried out when warned of his danger, Let me alone, for I ſee check-mate againſt Kuthar! We are told that Charles I. was at cheſs when news were brought of the final intention of the Scots to ſell him to the Engliſh; but ſo little was he diſcompoſed by this alarming intelligence, that he continued his game with the utmoſt compoſure; ſo that no perſon could have known that the letter he received had given him information of any thing remarkable. King John was playing at cheſs when the deputies from Rouen came to acquaint him that their city was beſieged by Philip Auguſtus; but he would not hear them until he had finiſhed his game.

The following remarkable anecdote we have from Dr Robertſon in his Hiſtory of Charles V. John Frederic, elector of Saxony, having been taken priſoner by Charles, was condemned to death. The decree was intimated to him while at cheſs with Erneſt of Brunſwic, his fellow-priſoner. After a ſhort pauſe, and making ſome reflections on the irregularity and injuſtice of the emperor's proceedings, he turned to his antagoniſt, whom he challenged to finiſh the game. He played with his uſual ingenuity and attention; and having beat Erneſt, expreſſed all the ſatisfaction that is commonly felt on gaining ſuch victories. He was not, however, put to death, but ſet at liberty after five years confinement.

In the Chronicle of the Mooriſh kings of Granada we find it related, that in 1396, Mehemed Balba ſeized upon the crown in prejudice of his elder brother, and paſſed his life in one continual round of diſaſters. His wars with Caſtile were invariably unſucceſsful; and his death was occaſioned by a poiſoned veſt. Finding his caſe deſperate, he diſpached an officer to the fort of Salobrena to put his brother Juzaf to death, leſt that prince's adherents ſhould form any obſtacle to his ſon's ſucceſſion. The alcayde found the prince playing at cheſs with an *alfaqui* or prieſt. Juzaf begged hard for two hours reſpite, which was denied him; at laſt with great reluctance the officer permitted him to finiſh the game; but before it was finiſhed a meſſenger arrived with the news of the death of Mehemed, and the unanimous election of Juzaf to the crown.

We have a curious anecdote of Ferrand count of Flanders; who having been accuſtomed to amuſe himſelf at cheſs with his wife, and being conſtantly beaten by her, a mutual hatred took place; which came to ſuch an height, that when the count was taken priſoner at the battle of Bovines, ſhe ſuffered him to remain a long time in priſon though ſhe could eaſily have procured his releaſe.

The game of cheſs has undergone conſiderable variations ſince it was firſt invented. We have it on good authority, that among the eaſtern nations, the piece now called the *queen* was formerly called the *vizir* or king's miniſter, and that the powers of the queen herſelf were but very ſmall. The cheſs-boards uſed by Tamerlane were larger, and contained many more ſquares, than thoſe at preſent in uſe. Carrera invented two new pieces to be added to the eight commonly in uſe. One of theſe, which he calls *campione*, is placed between the king's knight and caſtle; the other, named *Centaur*, between the queen's knight and caſtle, has the move of the biſhop and knight united. This invention, however, did not ſurvive its author. In another of this kind, the two additional pieces are called the *centurion* and *decurion*; the former, ſituated between the king and his biſhop, in its move the ſame with that of the queen, but only for two ſquares; the latter moves as the biſhop, but only one ſquare at a time. This, like the former, died with its inventor. The cheſs-board of Tamerlane was a parallelogram, having eleven ſquares one way and twelve the other. In the Memoirs of the late Marſhal Keith, we find it related, that he invented an amuſement ſomething ſimilar to that of cheſs, with which the king of Pruſſia was highly entertained. Several thouſand ſmall ſtatues were caſt by a founder; and theſe were ranged oppoſite to each other as if they had been drawn up in an army; making the different movements with them as in real ſervice in the field.

A very complicated kind of game at cheſs was invented by the late duke of Rutland. At this the board has 14 ſquares in breadth and 10 in height, which make in all 140 houſes: and there are 14 pawns on each ſide, which may move either one, two, or three ſquares the firſt time. The other pieces were the king, queen, two biſhops, two knights, a crowned caſtle uniting the move of the king and caſtle, and a common caſtle. On the other ſide of the king was a *concubine*, whoſe move united that of the caſtle and knight, two biſhops, a ſingle knight, a crowned caſtle, and a common one. In this game the pawns are of very little uſe; and by the extent of the board, the knights loſe much of their value, which conſequently renders the game more defective and leſs intereſting than the common one.

There is an amuſing variety at the game of cheſs, in which the king with eight pawns engages the whole ſet, by being allowed to make two moves for every one of his adverſary. In this he is almoſt certain of coming off victorious; as he can make his firſt move into check, and the ſecond out of it. Thus he can take the queen when ſhe ſtands immediately before her king, and then retreat; for he cannot remain in check. He cannot be check-mated unleſs his adverſary has preſerved his queen and both caſtles.

CHESS-*Trees, taquets d'amure*; two pieces of wood bolted perpendicularly, one on the ſtarboard, and another on the larboard, ſide of the ſhip. They are uſed to confine the *clue*, or lower corners of the main-ſail; for which purpoſe there is a hole in the upper part, through which the rope paſſes that uſually extends the clue of the ſail to windward. See TACK.

The cheſs-trees are commonly placed as far before the main-maſt as the length of the main-beam.

CHEST, in commerce, a kind of meaſure, containing an uncertain quantity of ſeveral commodities.

A cheſt of ſugar, *v. g.* contains from ten to fifteen hundred weight; a cheſt of glaſs, from two hundred to three hundred feet: of Caſtile ſoap, from two and an half to three hundred weight; of indigo, from one and an half to two hundred weight, five ſcore to the hundred.

CHEST, or *Thorax*. See ANATOMY, Part IV.

CHESTER, commonly called *Weſt-Cheſter*, to diſtinguiſh it from many other Cheſters in the kingdom; the capital of Cheſhire, in England. It is a very ancient city, ſuppoſed to have been founded by the Romans; and plainly appears to have been a Roman ſtation by the many antiquities which have been and are ſtill diſcovered in and about the town. It was among the laſt places the Romans quitted; and here the Britons maintained their liberty long after the Saxons had got poſſeſſion of the reſt of their country. At preſent it is a large well-built wealthy city, and carries on a conſiderable trade. Mr Pennant calls it *a city without parallel*, on account of the ſingular ſtructure of the four principal ſtreets. They are as if excavated out of the earth, and ſunk many feet beneath the ſurface; the carriages drive far beneath the level of the kitchens on a line with ranges of ſhops. The houſes are moſtly of wood, with galleries, piazzas, and covered walks before them; by which not only the ſhops, but thoſe who are walking about the town, are ſo hid, that one would imagine there were ſcarce any inhabitants in it, though it is very populous. But though by this contrivance ſuch as walk the ſtreets are ſcreened from rain, &c. yet the ſhops are thereby rendered dark and inconvenient. The back courts of all the houſes are on a level with the ground; but to go into any of the four principal ſtreets, it is neceſſary to deſcend a flight of ſeveral ſteps.

Cheſter is a biſhop's ſee. It was anciently part of the dioceſe of Litchfield; one of whoſe biſhops removing the ſeat of his ſee hither in the year 1075, occaſioned his ſucceſſors to be frequently ſtyled *biſhops of Cheſter*. But it was not erected into a diſtinct biſhopric until the general diſſolution of monaſteries, when king Henery VIII. in the year 1541, raiſed it to this dignity, and allotted the church of the abbey of St Werburgh for the cathedral, ſtyling it the *cathedral church of Chriſt and the bleſſed Virgin*: adding the biſhopric to the province of Canterbury: but ſoon after he disjoined it from Canterbury, and added it to the province of York. When this abbey was diſſolved, its revenues were valued at L. 1003 : 5 : 11. This dioceſe contains the entire counties of Cheſter and Lancaſter, part of the counties of Weſtmoreland, Cumberland, and Yorkſhire, two chapelries in Denbyſhire, and five pariſhes in Flintſhire; amounting in all to 256 pariſhes, of which 101 are impropriations. This biſhopric is valued in the king's books at L.420 : 1 ; 8, and is computed to be worth annually L.2700; the clergy's tenth amounting to L435 : 12 : 0. To this cathedral belong a dean, two archdeacons, a chancellor, a treaſurer, ſix prebendaries, and other inferior officers and ſervants. W. Long. 3. 0. N. Lat. 53. 12.

CHESTER-*le-Street*, the *Cuneacaſtre* of the Saxons: a ſmall thoroughfare town between Newcaſtle and Durham, with a good church and fine ſpire. In the Saxon times this place was greatly reſpected on account of the relics of St Cuthbert, depoſited here by biſhop Eardolf, for fear of the Danes, who at that time (about 884) ravaged the country. His ſhrine became afterwards an object of great devotion. King Athelſtan, on his expedition to Scotland, paid it a viſit, to obtain, by interceſſion of the ſaint, ſucceſs on his arms; beſtowed a multitude of gifts on the church; and directed, in caſe he died in his enterprize, that his body ſhould be enterred there. At the time that this place was honoured with the remains of St Cuthbert, the biſhopric of Lindesfarn was removed here, and endowed with all the lands between the Tyne and the Were, the preſent county of Durham. It was ſtyled *St Cuthbert's patrimony*. The inhabitants had great privileges, and always thought themſelves exempt from all military duty, except that of defending the body of their ſaint. Cheſter-le-ſtreet may be conſidered as the parent of the ſee of Durham; for when the relics were removed there, the ſee in 995 followed them. Tanner ſays, that probably a chapter of monks, or rather ſecular canons, attended the body at this place from its firſt arrival; but biſhop Beke, in 1286, in honour of the ſaint, made the church collegiate, and eſtabliſhed here a dean and ſuitable eccleſiaſtics; and, among other privileges, gives the dean a right of fiſhing on the Were, and the tythe of fiſh.

New CHESTER, a town in the ſtate of Pennſylvania, and capital of a county of that name. It is ſeated on the Delaware; and has a fine capacious harbour, admitting veſſels of any burden. W. Long. 74. 7. N. Lat. 40. 15.

CHESTERFIELD, a market town of Derbyſhire in England, pleaſantly ſituated on a hill between two ſmall rivers. It has the title of an earldom; and a conſiderable market for corn, lead, and other country commodities. The houſes are, for the moſt part, built of rough ſtone, and covered with ſlate. W. Long. 1.25. N. Lat. 53. 20.

CHESTERFIELD (Earl of). See STANHOPE.

CHEVAL *de* FRISE, a large piece of timber pierced, and traverſed with wooden ſpikes, armed or pointed with iron, five or ſix feet long. See Plate CXXXVI.

The term is French and properly ſignifies a *Frieſland horſe*; as having been firſt invented in that country.—It is alſo called a *Turnpike* or *Turniquet*.

Its uſe is to defend a paſſage, ſtop a breach, or make a retrenchment to ſtop the cavalry. It is ſometimes alſo mounted on wheels, with artificial fires, to roll down in an aſſault. Errard obſerves, that the prince of Orange uſed to incloſe his camp with *chevaux de Friſe*, placing them one over another.

CHEVALER, in the manege, is ſaid of a horſe, when, in paſſaging upon a walk or trot, his off fore-leg croſſes or overlaps the near fore-leg every ſecond motion.

CHEVALIER, a French term, ordinarily ſignifying a KNIGHT. The word is formed of the French *cheval*, "horſe;" and the barbarous Latin *cavallus*.

It is uſed, in heraldry, to ſignify any *cavalier*, or horſeman armed at all points; by the Romans called *cataphractus eques*: now out of uſe, and only to be ſeen in coat-armour.

CHEVAUX *de* FRISE. See CHEVAL *de Friſe*.

CHEVIN, a name uſed in ſome parts of England for the CHUB.

CHEVIOT (or TIVIOT) HILLS, run from north to ſouth through Cumberland; and were formerly the borders or boundaries between England and Scotland, where many a bloody battle has been fought between the two nations; one of which is recorded in the ballad of Chevy-chaſe. Theſe hills are the firſt land diſcovered by ſailors in coming from the eaſt into Scotland.

CHEVISANCE, in law, denotes an agreement or compoſition, as an end or order ſet down between a creditor and his debtor, *&c.* In the ſtatutes, this word is moſt commonly uſed for an unlawful bargain or contract.

CHEVREAU (Urban), a learned writer, born at Lundun in 1613. He diſtinguiſhed himſelf in his youth by his knowledge of the belles lettres; and became ſecretary of ſtate to queen Chriſtina of Sweden. Several German princes invited him to their courts; and Charles-Lewis, the elector palatine, retained him under the title of counſellor. After the death of that prince, he returned to France, and became preceptor to the duke of Maine. At length retiring to Lundun, he died there in 1701, aged 88. He was the author of ſeveral books; and amongſt others, of an Univeſal Hiſtory, which has been often reprinted.

CHEVRON, or CHEVERON, in heraldry. See HERALDRY.

CHEWING-BALLS, a kind of balls made of aſafoetida, liver of antimony, bay-wood, juniper-wood, and pellitory of Spain; which being dried in the ſun, and wrapped in a linen cloth, are tied to the bit of the bridle for the horſe to chew; they create an appetite; and it is ſaid, that balls of Venice-treacle may be uſed in the ſame manner with good ſucceſs.

CHEYKS. See BENGAL, n° 17.

CHEYNE (Dr George), a phyſician of great learning and abilities, born in Scotland in 1671, and educated at Edinburgh under the great Dr Pitcairn. He paſſed his youth in cloſe ſtudy, and with great temperance: but coming to ſettle at London, when about 30, and finding the younger gentry and free-livers to be the moſt eaſy of acceſs and moſt ſuſceptible of friendſhip, he changed on a ſudden his former manner of living in order to force a trade, having obſerved this method to ſucceed with ſome others. The conſequence was, that he grew daily in bulk, and in intimacy with his gay acquaintance; ſwelling to ſuch an enormous ſize, that he exceeded 32 ſtone weight; and he was forced to have the whole ſide of his chariot made open to receive him into it; he grew ſhort-breathed, lethargic, nervous, and ſcorbutic; ſo that his life became an intolerable burden. In this deplorable condition, after having tried all the power of medicine in vain, he reſolved to try a milk and vegetable diet; the good effects of which quickly appeared. His ſize was reduced almoſt a third; and he recovered his ſtrength, activity, and cheerfulneſs, with the perfect uſe of all his faculties. In ſhort, by a regular adherence to this regimen, he lived to a mature period, dying at Bath in 1742, aged 72. He wrote ſeveral treatiſes that were well received; particularly, "An Eſſay on Health and Long Life;" and "The Engliſh Malady, or a Treatiſe of Nervous Diſeaſes;" both the reſult of his own experience. In ſhort, he had great reputation in his own time, both as a practitioner and as a writer; and moſt of his pieces paſſed thro' ſeveral editions. He is to be ranked among thoſe phyſicians who have accounted for the operations of medicines and the morbid alterations which take place in the human body upon mechanical principles. A ſpirit of piety and of benevolence, and an ardent zeal for the intereſts of virtue, are predominant throughout his writings. An amiable candour and ingenuouſneſs are alſo diſcernible, and which led him to retract with readineſs whatever appeared to him to be cenſurable in what he had formerly advanced. Some of the metaphyſical notions which he has introduced into his books, may, perhaps, juſtly be thought fanciful and ill-grounded; but there is an agreeable vivacity in his productions, together with much openneſs and frankneſs, and in general great perſpicuity.

CHIABRERA (Gabriel), eſteemed the Pindar of Italy, was born at Savona in 1552, and went to ſtudy at Rome. The Italian princes, and Urban VIII. gave him public marks of their eſteem. He wrote a great number of poems; but his lyric verſes are moſt admired. He died at Savona in 1638, aged 86.

CHIAN EARTH, in pharmacy, one of the medicinal earths of the ancients, the name of which is preſerved in the catalogues of the materia medica, but of which nothing more than the name has been known for many ages in the ſhops.

It is a very denſe and compact earth; and is ſent hither in ſmall flat pieces from the iſland of Chios, in which it is found in great plenty at this time. It ſtands recommended to us as an aſtringent. They tell us, it is the greateſt of all coſmetics; and that it gives a whiteneſs and ſmoothneſs to the ſkin, and prevents wrinkles, beyond any of the other ſubſtances that have been celebrated for the ſame purpoſes.

CHIAOUS, a word in the original Turkiſh, ſignifying "envoys," are officers to the number of five or ſix hundred in the grand ſignior's court, under the command of a chiaous baſchi. They frequently meet in the grand viſir's palace, that they may be in readineſs to execute his orders, and carry his diſpatches into all the provinces of the empire. The chiaous baſchi aſſiſts at the divan, and introduces thoſe who have buſineſs there.

CHIAPA, the capital of a province of the ſame name in Mexico, ſituated about 300 miles eaſt of Acapulco. W. Long. 98. 0. N. Lat. 16. 30.

Chiapa el Real, a town of Mexico, in a province of the ſame name, with a biſhop's ſee. Its principal trade conſiſts in chocolate-nuts, cotton, and ſugar. W. Long. 98. 35. N. Lat. 16. 20.

Chiapas de los Indos, a large and rich town of North America, in Mexico, and in a province of the ſame name. The governor and moſt of the inhabitants are originally Americans. W. Long. 98. 5. N. Lat. 15. 6.

CHIARI (Joſeph), a celebrated Italian painter, was the diſciple of Carlo Maratti; and adorned the churches and palaces of Rome with a great number of fine paintings. He died of an apoplexy in 1727, aged 73.

CHIARI, a town of Italy, in the province of Breſcia, and territory of Venice, 7 miles weſt of Breſcia, and 27 eaſt of Milan. Here the Imperialiſts gained a victory over the French in 1701. E. Long. 18. 18. N. Lat. 45. 30.

CHIARO-SCURO. See *Claro-Obſcuro.*

CHIAVENNA, a handſome, populous, and large town of Swiſſerland, in the country of the Griſons. It is a trading place, eſpecially in wine and delicate fruits. The governor's palace and the churches are very magnificent, and the inhabitants are Roman Catholics. It is ſeated near the lake Como. E. Long. 9. 29. N. Lat. 46. 15.

CHIAUSI, among the Turks, officers employed in executing the vizirs, baſhaws, and other great men: the orders for doing this, the grand ſignior ſends them wrapped up in a black cloth; on the reception of which, they immediately perform their office.

CHICANE, or CHICANERY, in law, an abuſe of judiciary proceeding, tending to delay the cauſe, to puzzle the judge, or impoſe upon the parties.

CHICANE, in the ſchools, is applied to vain ſophiſms, diſtinctions, and ſubtleties, which protract diſputes, and obſcure the truth.

CHICHESTER, the capital city of the county of Suſſex in England, was built by Ciſſa, the 2d king of the South Saxons, and by him called *Ciſſan Caeſter*. It is ſurrounded with a wall, which has four gates, anſwering to the four cardinal points; from which run two ſtreets, that croſs one another in the middle and form a ſquare, where the market is kept, and where there is a fine ſtone piazza built by biſhop Read. The ſpace between the weſt and ſouth gates is taken up with the cathedral church and the biſhop's palace. It has five pariſh-churches; and is ſeated on the little river Lavant, which waſhes it on all ſides except the north. This city would have been in a much more flouriſhing condition if it had been built by the ſea-ſide; however, the inhabitants have endeavoured to ſupply this defect in ſome meaſure, by cutting a canal from the city down into the bay. The principal manufactures of the town are malt and needles. The market of Chicheſter is noted for fiſh, wheat, barley, malt, and oats; the fineſt lobſters in England are bred in the Lavant; and it is obſervable, that this river, unlike moſt others, is very low in winter, but in ſummer often overflows its banks. Chicheſter is a city and county of itſelf; it is governed by a mayor, recorder, aldermen, common-council without limitation, and four juſtices of the peace choſen out of the aldermen; and it ſends two members to parliament. It is a biſhop's ſee. The cathedral church was anciently dedicated to St Peter. It was new built by Radulph, the twenty-fifth biſhop; but being deſtroyed by fire, it was again built by Seffridus II. the twenty-ninth biſhop. This ſee hath yielded to the church two ſaints, and to the nation three lord chancellors, two almoners, and one chancellor to the univerſity of Oxford. Anciently the biſhops of Chicheſter were confeſſors to the queens of England. This dioceſe contains the whole of the county of Suſſex (excepting 22 pariſhes, peculiars of the archbiſhop of Canterbury), wherein are 250 pariſhes, whereof 112 are impropriated. It hath two archdeacons, viz. of Chicheſter and Lewes; is valued in the king's books at L.677 : 1 : 3, and is computed to be worth annually L.2600. The tenths of the whole clergy is L.287 : 2 : 0¾. To the cathedral belong a biſhop, a dean, two archdeacons, a treaſurer, a chancellor, thirty-two prebendaries, a chanter, twelve vicars-coral, and other officers. W. Long. 50. N. Lat. 50. 50.

CHICK, or CHICKEN, in zoology, denotes the young of the gallinaceous order of birds, eſpecially the common hen. See PHASIANUS.

CHICK-Weed, in botany. See ALSINE.

CHICKEN-Pox. See (*Index ſubjoined to*) MEDICINE.

CHICKLING-PEA, in botany, a name given to the LATHYRUS.

CHICUITOS, a province of South America, in the government of Santo Cruz de la Sierra. The chief riches conſiſt of honey and wax; and the original inhabitants are very voluptuous, yet very warlike. They maintained bloody wars with the Spaniards till 1690; ſince which, ſome of them have become Chriſtians. It is bounded by la Plata on the N. E. and by Chili on the W.

CHIDLEY, or CHIMLEY, a market-town of Devonſhire, ſituated in W. Long. 4. 0. N. Lat. 51. 0.

CHIEF, a term ſignifying the head or principal part of a thing or perſon. Thus we ſay, the chief of a party, the chief of a family, *&c.* The word is formed of the French *chef*, "head;" of the Greek κεφαλη, *caput*, "head;" though Menage derives it from the Italian *capo*, formed of the Latin *caput*.

CHIEF, in heraldry, is that which takes up all the upper part of the eſcutcheon from ſide to ſide, and repreſents a man's head. *In chief*, imports ſomething borne in the chief part or top of the eſcutcheon.

CHIEFTAIN, denotes the captain or chief of any claſs, family, or body of men. Thus the chieftains or chiefs of the Highland clans, were the principal noblemen or gentlemen of their reſpective clans. See CLANS.

CHIELEFA, a ſtrong town of Turkey in Europe, in the Morea. It was taken by the Venetians in 1685; but after that the Turks retook it, with all the Morea. E. Long. 22. 21. N. Lat. 36. 50.

CHIGI (Fabio), or Pope Alexander VII. was born at Sienna in 1599. His family finding him a hopeful youth, ſent him early to Rome, where he ſoon engaged in a friendſhip with the marquis Pallavicini, who recommended him ſo effectually to Pope Urban VIII. that he procured him the poſt of Inquiſitor at Malta. He was ſent vice-legate to Ferrara, and afterward nuncio into Germany: there he had an opportunity of diſplaying his intriguing genius; for he was mediator at Munſter, in the long conference held to conclude a peace with Spain. Cardinal Mazarin had ſome reſentment againſt Chigi, who was ſoon after made a cardinal and ſecretary of ſtate by Innocent X. but his reſentment was ſacrificed to political views. In 1655, when a pope was to be choſen, Cardinal Sacchetti, Mazarin's great friend, finding it was impoſſible for him to be raiſed into St Peter's chair becauſe of the powerful oppoſition made by the Spaniſh faction, deſired Cardinal Mazarin to conſent to Chigi's exaltation. His requeſt was granted, and he was elected pope by the votes of all the 64 cardinals who were in the conclave: an unanimity of which there are but few inſtances in the election of popes. He ſhowed uncommon humility at his election, and at firſt forbade all his relations to come to Rome without his leave; but he ſoon became more favourable to his nephews, and loaded them with favours. It is aſſerted that he had once a mind to turn Proteſtant. The news-papers in Holland beſtowed great encomiums upon him; and acquainted the world, that he did not approve of the cruel perſecutions of the Waldenſes in Piedmont. There is a volume of his poems extant. He loved the *Belles-Lettres*, and the converſation of learned men. He was extremely fond of ſtately buildings: the grand plan of the college *Della Sapienza*, which he finiſhed, and adorned with a fine library, remains a proof of his taſte in architecture. He died in 1667.

CHILBLAIN, (*pernio*), in medicine, a tumour affecting the feet and hands; accompanied with an inflammation, pains, and ſometimes an ulcer or ſolution of continuity: in which caſe it takes the denomination of *chaps* on the hands, and of *kibes* on the heels. Chilblain is compounded of *chill* and *blain*; *q. d.* a blain or ſore contracted by cold. *Pernio* is the Latin name adopted by phyſicians; and is derived by Voſſius from *perna* "a gammon of bacon," on account of ſome reſemblance. *Chap* alludes to *gape*, both in ſound and appearance. *Kibes*, in welch *kibws*, may be derived from the German *kerben*, "to cut;" the ſkin, when broke, appearing like a cut.

Chilblains are occaſioned by exceſſive cold ſtopping the motion of the blood in the capillary arteries. See the article PERNIO.

CHILD, a term of relation to *parent*. See PARENT and CHILDREN.

Bartholine, Paré, Licetus, and many other writers, give an account of a petrified child, which has ſeemed wholly incredible to ſome people. The child, however, which they deſcribe, is ſtill in being; and is kept as a great rarity in the king of Denmark's muſeum at Copenhagen. The woman who was big with this, lived at Sens in Champaign in the year 1582; it was cut out of her belly, and was univerſally ſuppoſed to have lain there about 20 years. That it is a real human fœtus, and not artificial, is evident to the eyes of any obſerver; and the upper part of it, when examined, is found to be of a ſubſtance reſembling the gypſum, or ſtone whereof they make the plaſter of Paris: the lower part is much harder; the thighs and buttocks being a perfect ſtone of a reddiſh colour, and as hard as common quary-ſtone: the grain and ſurface of this part appears exactly like that of the calculi, or ſtones taken out of human bladders: and the whole ſubſtance examined ever ſo nearly, and felt ever ſo carefully, appears to be abſolute ſtone. It was carried from Sens to Paris, and there purchaſed by a goldſmith of Venice; and Frederic III. king of Denmark, purchaſed it of this man at Venice for a very large ſum, and added it to his collection of rarities.

CHILD-Bed, }
CHILD-Birth. } See MIDWIFERY.

CHILD-Wit, a power to take a fine of a bond-woman unlawfully gotten with child, that is, without conſent of her lord. Every reputed father of a baſe child got within the manor of Writtel in Eſſex, in England, pays to the lord a fine of 3s. 4d.; where, it ſeems, child-wit extends to free as well as bond-women.

CHILDERMAS-DAY, or *INNOCENT's Day*, an anniverſary held by the church of England on the 28th of December, in commemoration of the children of Bethlehem maſſacred by order of Herod.

CHILDREN, the plural of CHILD.

Mr Derham computes, that marriages, one with another, produce four children, not only in England, but in other parts alſo.

In the genealogical hiſtory of Tuſcany, wrote by Gamarini, mention is made of a nobleman of Sienna, named Pichi, who of three wives had 150 *children*; and that, being ſent ambaſſador to the pope and the emperor, he had 48 of his ſons in his retinue. In a monument in the church yard of St Innocent, at Paris, erected to a woman who died at 88 years of age, it is recorded, that ſhe might have ſeen 288 *children* directly iſſued from her. This exceeds what Hakewell relates of Mrs Honeywood, a gentlewoman of Kent, in England born in the year 1527, and married at 16 to her only huſband R. Honeywood, of Charing, Eſq; and died in her 93d year. She had 16 *children* of her own body; of which three died young, and a fourth had no iſſue: yet her *grandchildren*, in the ſecond generation, amounted to 114; in the third, to 228; though in the fourth, they fell to 9. The whole number ſhe might have ſeen in her life-time, being 367. 16+114+228+9=367. So that ſhe could ſay the ſame as the diſtich does of one of the Dalburg's family at Baſil:

1 2 3 4
Mater ait natæ dic natæ filia natam,
5 6
Ut moneat, natæ, plangere, filiolam.

Management of CHILDREN. See INFANT.

Overlaying of CHILDREN, is a misfortune that frequently happens; to prevent which, the Florentines have contrived an inſtrument called *arcuccio*. See ARCUCCIO.

CHILDREN are, in law, a man's iſſue begotten on his wife. As to *illegitimate children*, ſee BASTARD.

For the legal duties of parents to their children, ſee the articles PARENT and BASTARD.

As to the duties of children to their parents, they ariſe from a principle of natural juſtice and retribution. For to thoſe who gave us exiſtence, we naturally owe ſubjection and obedience during our minority, and honour and reverence ever after: they who protected the weakneſs of our infancy, are intitled to our protection in the infirmity of their age; they who by ſuſtenance and education have enabled their offspring to proſper, ought, in return, to be ſupported by that offspring, in caſe they ſtand in need of aſſiſtance. Upon this principle proceed all the duties of children to their parents, which are enjoined by poſitive laws. And the Athenian laws carried this principle into practice with a ſcrupulous kind of nicety: obliging all children to provide for their father when fallen into poverty; with an exception to ſpurious children, to thoſe whoſe chaſtity had been proſtituted with conſent of their father, and to thoſe whom he had not put in any way of gaining a livelihood. The legiſlature, ſays baron Monteſquieu, conſidered, that, in the firſt caſe, the father, being uncertain, had rendered the natural obligation precarious; that, in the ſecond caſe, he had ſullied the life he had given, and done his children the greateſt of injuries, in depriving them of their reputation; and that, in the third caſe, he had rendered their life (ſo far as in him lay) an inſupportable burden, by furniſhing them with no means of ſubſiſtence.

Our laws agree with thoſe of Athens, with regard to the firſt only of theſe particulars, the caſe of ſpurious iſſue. In the other caſes, the law does not hold the tie of nature to be diſſolved by any miſbehaviour of the parent; and therefore a child is equally juſtifiable in defending the perſon, or maintaining the cauſe or ſuit, of a bad parent as of a good one; and is equally compellable, if of ſufficient ability, to maintain and provide for a wicked and unnatural progenitor, as for one who has ſhown the greateſt tenderneſs and parental piety. See further the article FILIAL *Affection*.

CHILI, a province of South America, bounded by Peru on the north, by the province of La Plata on the eaſt, by Patagonia on the ſouth, and by the Pacific ocean on the weſt, lying between 75 and 85 degrees of weſt longitude, and between 25 and 45 degrees of ſouth latitude; though ſome comprehend in this province Patagonia and Terra del Fuego.

The firſt attempt of the Spaniards upon this country was made by Almagro in the year 1535, after he and Pizaro had completed the conqueſt of Peru. He ſet out on his expedition to Chili with a conſiderable body of Spaniards and auxiliary Indians. For 200 leagues he was well accommodated with every neceſſary by the Indians, who had been ſubjects of the emperors of Peru: but reaching the barren country of Charcas, his troops became diſcontented through the hardſhips they ſuffered; which determined Almagro to climb the mountains called Cordilleras, in order to get the ſooner into Chili; being ignorant of the invaluable mines of Potoſi, contained in the province of Charcas where he then was. At that time the Cordilleras were covered with ſnow, the depth of which obliged him to dig his way through it. The cold made ſuch an impreſſion on his naked Indians, that it is computed no leſs than 10,000 of them periſhed on theſe dreadful mountains, 150 of the Spaniards ſharing the ſame fate; while many of the ſurvivors loſt their fingers and toes through the exceſs of cold. At laſt, after encountering incredible difficulties, Almagro reached a fine, temperate, and fertile plain on the oppoſite ſide of the Cordilleras, where he was received with the greateſt kindneſs by the natives. Theſe poor ſavages, taking the Spaniards for deputies of their god Virachoca, immediately collected for them an offering of gold and ſilver worth 200,000 ducats: and ſoon after brought a preſent to Almagro worth 300,000 more. Theſe offerings only determined him to conquer the whole country as ſoon as poſſible. The Indians among whom he now was, had acknowledged the authority of the Peruvian incas, or emperors, and conſequently gave Almagro no trouble. He therefore marched immediately againſt thoſe who had never been conquered by the Peruvians, and inhabited the ſouthern parts of Chili. Theſe ſavages fought with great reſolution, and diſputed every inch of ground: but in five months time the Spaniards had made ſuch progreſs, that they muſt infallibly have reduced the whole province in a very little time, had not Almagro returned to Peru, in conſequence of a commiſſion ſent him from Spain.

In 1540, Pizaro having overcome and put Almagro to death, ſent into Chili, Baldivia, or Valdivia, who had learned the rudiments of war in Italy, and was reckoned one of the beſt officers in the Spaniſh ſervice. As he penetrated ſouthwards, however, he met with much oppoſition; the confederated caziques frequently gave him battle, and diſplayed great courage and reſolution; but could not prevent him from penetrating to the valley of Maſiocho, which he found incredibly fertile and populous. Here he founded the city of St Jago; and finding gold mines in the neighbourhood, forced the Indians to work in them; at the ſame time building a caſtle for the ſafety and protection of his new colony. The natives, exaſperated at this ſlavery, immediately took up arms; attacked the fort; and, though defeated and repulſed, ſet fire to the outworks, which contained all the proviſions of the Spaniards. Nor were they diſcouraged by this and many other defeats, but ſtill continued to carry on the war with vigour. At laſt, Valdivia, having overcome them in many battles, forced the inhabitants of the vale to ſubmit; upon which he immediately ſet them to work in the mines of Quilotta. This indignity offered to their countrymen redoubled the fury of thoſe who remained at liberty. Their utmoſt efforts, however, were as yet unable to ſtop Valdivia's progreſs. Having croſſed the large rivers Maulle and Hata, he traverſed a vaſt tract of country, and founded the city of La Conception on the South-ſea-coaſt. He erected fortreſſes in ſeveral parts of the country, in order to keep the natives in awe; and built the city called *Imperial*, about 40 leagues to the ſouthward of Conception. The Spaniſh writers ſay that the neighbouring valley contained 80,000 inhabitants of a peaceable diſpoſition; and who were even ſo tame as to ſuffer Valdivia to parcel out their lands among his followers, while they themſelves remained in a ſtate of inactivity. About 16 leagues to the eaſtward of Imperial, the Spaniſh general laid the foundations of the city *Villa Rica*, ſo called on account of the rich gold mines he found there. But his ambition and avarice had now involved him in difficulties from which he could never be extricated: He had extended his conqueſts beyond what his ſtrength was capable of maintaining. The Chileſians were ſtill as deſirous as ever of recovering their liberties. The horſes, fire-arms, and armour of the Spaniards, indeed, appeared dreadful to them; but thoughts of endleſs ſlavery were ſtill more ſo. In the courſe of the war they had diſcovered that the Spaniards were vulnerable and mortal men like themſelves; they hoped, therefore, by dint of their ſuperiority in numbers, to be able to expel the tyrannical uſurpers. Had all the nations joined in this reſolution, the Spaniards had certainly been exterminated; but ſome of them were of a pacific and fearful diſpoſition, while others conſidered ſervitude as the greateſt of all poſſible calamities. Of this laſt opinion were the Araceeans, the moſt intrepid people in Chili, and who had given Valdivia the greateſt trouble. They all roſe to a man, and choſe Capaulican, a renowned hero among them, for their leader. Valdivia, however, received notice of their revolt ſooner than they intended he ſhould, and returned with all expedition to the vale of Araceea; but before he arrived, 14,000 of the Chileſians were there aſſembled under the conduct of Capaulican. He attacked them with his cavalry, and forced them to retreat into the woods; but could not obtain a complete victory, as they kept continually ſallying out and haraſſing his men. At laſt Capaulican, having obſerved that fighting with ſuch a number of undiſciplined troops only ſerved to contribute to the defeat and confuſion of the whole, divided his forces into bodies of 1000 each. Theſe he directed to attack the enemy by turns; and, though he did not expect that a ſingle thouſand would put them to flight, he directed them to make as long a ſtand as they could; when they were to be relieved and ſupported by another body; and thus the Spaniards would be at laſt wearied out and overcome. The event fully anſwered his expectations. The Chileſians maintained a fight for ſeven or eight hours, until the Spaniards, growing faint for want of refreſhment, retired precipitately. Valdivia ordered them to poſſeſs a paſs at ſome diſtance from the field, to ſtop the purſuit; but this deſign being diſcovered to the Chileſians by the treachery of his page, who was a native of that country, the Spaniards were ſurrounded on all ſides, and cut in pieces by the Indians. The general was taken and put to death: ſome ſay with the tortures uſually inflicted by thoſe ſavages on their priſoners; others, that he had melted gold poured down his throat; but all agree, that the Indians made flutes and other inſtruments of his bones, and preſerved his ſkull as a monument of their victory, which they celebrated by an annual feſtival. After this victory the Chileſians had another engagement with their enemies; in which alſo they proved victorious, defeating the Spaniards with the loſs of near 3000 men; and upon this they bent their whole force againſt the colonies. The city of Conception, being abandoned by the Spaniards, was taken and deſtroyed: but the Indians were forced to raiſe the ſiege of Imperial; and their progreſs was at laſt ſtopped by Garcia de Mendoza, who defeated Capaulican, took him priſoner, and put him to death. No defeats, however, could diſpirit the Chileſians. They continued the war for 50 years; and to this day they remain unconquered, and give the Spaniards more trouble than any other American nation. Their moſt irreconcileable enemies are the inhabitants or Araceea and Tucapel, thoſe to the ſouth of the river Bobio, or whoſe country extends towards the Cordilleras.—The manners of theſe people greatly reſemble thoſe of North America, which we have already deſcribed under the article AMERICA; but ſeem to have a more warlike diſpoſition. It is a conſtant rule with the Chileſians never to ſue for peace. The Spaniards are obliged not only to make the firſt overtures, but to purchaſe it by preſents. They have at laſt been obliged to abandon all thoughts of extending their conqueſts, and reduced to cover their frontiers by erecting forts at proper diſtances.

The Spaniſh colonies in Chili are diſperſed on the borders of the South-ſea. They are parted from Peru by a deſart 80 leagues in breadth; and bounded by the iſland of Chiloe, at the extremity next the ſtraits of Magellan. There are no ſettlements on the coaſts except that of Baldivia, Conception iſland, Valparaiſo, and Coquimbo or La Serena, which are all ſea-ports. In the inland country is St Jago, the capital of the colony. There is no culture nor habitation at any diſtance from theſe towns. The buildings in the whole province are low, made of unburnt brick, and moſtly thatched. This practice is obſerved on account of the frequent earthquakes; and is properly adapted to the nature of the climate, as well as the indolence of the inhabitants.

The climate of Chili is one of the moſt wholeſome in the whole world. The vicinity of the Cordilleras gives it ſuch a delightful temperature as could not otherwiſe be expected in that latitude. Though gold mines are found in it, their richneſs has been too much extolled; their produce never exceeds L. 218,750. The ſoil is prodigiouſly fertile. All the European fruits have improved in that happy climate. The wine would be excellent if nature were properly aſſiſted by art: and the corn-harveſt is reckoned a bad one when it does not yield a hundred fold. With all theſe advantages, Chili has no direct intercourſe with the mother-country. Their trade is confined to Peru, Paraguay, and the ſavages on their frontiers. With theſe laſt they exchange their leſs valuable commodities, for oxen, horſes, and their own children, whom they are ready to part with for the moſt trifling things. This province ſupplies Peru with great plenty of hides, dried fruit, copper, ſalt-meat, horſes, hemp, lard, wheat, and gold. In exchange, it receives tobacco, ſugar, cocoa, earthen-ware, woollen cloth, linen, hats, made at Quito, and every article of luxury brought from Europe. The ſhips ſent from Callao on this traffic were formerly bound to Conception Bay, but now come to Valparaiſo. The commerce between this province and Paraguay is carried on by land, though it is a journey of 300 leagues, 40 of which lie through the ſnows and precipices of Cordilleras; but if it was carried on by ſea, they muſt either paſs the ſtraits of Magellan or double Cape Horn, which the Spaniards always avoid as much as poſſible. To Paraguay are ſent ſome woollen ſtuffs called *ponchos*, which are uſed for cloaks; alſo wines, brandy, oil, and chiefly gold. In return they receive wax, a kind of tallow fit to make ſoap, European goods, and negroes.

Chili is governed by a chief, who is abſolute in all civil, political, and military affairs, and is alſo independent of the viceroy. The latter has no authority except when a governor dies; in which caſe he may appoint one in his room for a time, till the mother-country names a ſucceſſor. If, on ſome occaſions, the viceroy has interfered in the government of Chili, it was when he has been either authoriſed by a particular truſt repoſed in him by the court, or by the deference paid to the eminence of his office; or when he has been actuated by his own ambition to extend his authority. In the whole province of Chili there are not 20,000 white men, and not more than 60,000 negroes, or Indians, able to bear arms. The military eſtabliſhment amounted formerly to 2000 men; but the maintaining of them being found too expenſive, they were reduced to 500 at the beginning of this century.

CHILIAD, an aſſemblage of ſeveral things ranged by thouſands. The word is formed of the Greek χιλιας, *mille*, a thouſand.

CHILIAGON, in geometry, a regular plain figure of 1000 ſides and angles. Though the imagination cannot form the idea of ſuch a figure, yet we may have a very clear notion of it in the mind, and can eaſily demonſtrate that the ſum of all its angles is equal to 1996 right ones: for the internal angles of every plane figure are equal to twice as many right ones as the figure hath ſides, except thoſe four which are about the centre of the figure, from whence it may be reſolved into as many triangles as it has ſides. The author of *l'Art de Penſer*, p. 44. has brought this inſtance to ſhow the diſtinction between imagination and conceiving.

CHILIARCHA, or CHILIARCHUS, an officer in the armies of the ancients, who had the command of a thouſand men.

CHILIASTS, in church-hiſtory. See MILLENARIANS.

CHILLINGWORTH (William), an eminent divine of the church of England, was born at Oxford in 1602, and bred there. He made early great proficiency in his ſtudies, being of a very quick genius. He was an expert mathematician, as well as an able divine, and a very good poet. Study and converſation at the univerſity turning upon the controverſy between the church of England and that of Rome, on account of the king's marriage with Henrietta daughter to Henry IV. king of France, Mr Chillingworth forſook the church of England, and embraced the Romiſh religion. Dr Laud, then biſhop of London, hearing of this, and being greatly concerned at it, wrote Mr Chillingworth; who expreſſing a great deal of candour and impartiality, that prelate continued to correſpond with him. This ſet Mr Chillingworth on a new inquiry; and at laſt determined him to return to his former religion. In 1634 he wrote a confutation of the arguments which had induced him to go over to the church of Rome. He ſpoke freely to his friends of all the difficulties that occurred to him; which gave occaſion to a groundleſs report, that he had turned Papiſt a ſecond time, and then Proteſtant again. His return to the communion of the church of England made a great noiſe, and engaged him in ſeveral diſputes with thoſe of the Romiſh perſuaſion. But in 1635 he engaged in a work which gave him a far greater opportunity to confute the principles of the church of Rome, and to vindicate the Proteſtant religion, under the title of "The Religion of Proteſtants a ſafe way to Salvation." Sir Thomas Coventry, lord keeper of the great ſeal, offering him preferment, Mr Chillingworth refuſed to accept it on account of his ſcruples with regard to the ſubſcription of the 39 articles. However, he at laſt ſurmounted theſe ſcruples; and being promoted to the chancellorſhip of the church of Sarum, with the prebend of Brixworth in Northamptonſhire annexed to it, he complied with the uſual ſubſcription. Mr Chillingworth was zealouſly attached to the royal party; and, in Auguſt 1643, was preſent in King Charles I.'s army at the ſiege of Glouceſter, where he adviſed and directed the making certain engines for aſſaulting the town. Soon after, having accompanied the Lord Hopton, general of the king's forces in the weſt, to Arundel caſtle in Suſſex, he was there taken priſoner by the parliamentary forces under the command of Sir William Waller, who obliged the caſtle to ſurrender. But his illneſs increaſing, he obtained leave to be conveyed to Chicheſter, where he was lodged at the biſhop's palace; and, after a ſhort ſickneſs, died in 1644. He hath left ſeveral excellent works behind him.

CHILMINAR. See PERSEPOLIS.

CHILO, one of the ſeven ſages of Greece, and of the ephori of Sparta the place of his birth, flouriſhed about 556 years before Chriſt. He was accuſtomed to ſay, that there were three things very difficult: "To keep a ſecret; to know how beſt to employ our time; and to ſuffer injuries without murmuring." According to Pliny, it was he who cauſed the ſhort ſentence, *Know thyſelf*, to be written in letters of gold in the temple of Delphos. It is ſaid that he died with joy, while embracing his ſon, who had been crowned at the Olympic games.

CHILOE, an iſland lying near the coaſt of Chili, in South America, under the 43d degree of ſouth latitude. It is the chief of an archipelago of 40 iſlands, and its principal town is Caſtro. It rains here almoſt all the year, inſomuch that nothing but Indian corn, or ſome ſuch grain, that requires but little heat to ripen it, can ever come to perfection. They have excellent ſhell-fiſh, very good wild-fowl, hogs, ſheep, and beeves; as alſo a great deal of honey and wax. They carry on a trade with Peru and Chili; whither they ſend boards of cedar, of which they have vaſt foreſts.

CHILTENHAM, a town in Glouceſterſhire, England, ſix miles from Glouceſter; noted for its purgative chalybeat ſpring, which has rendered it of late years a place of faſhionable reſort. This water, which operates with great eaſe, is deemed excellent in ſcorbutic complaints, and has been uſed with ſucceſs in the gravel.

CHILTERN, a chain of chalky hills forming the ſouthern part of Buckinghamſhire, England, the northern part of the county being diſtinguiſhed by the name of the *Vale*. The air on theſe heights is extremely healthful: The ſoil, though ſtoney, produces good crops of wheat and barley; and in many places it is covered with thick woods, among which are great quantities of beach.—*Chiltern* is alſo applied to the hilly parts of Berkſhire, and it is believed has the ſame meaning in ſome other counties. Hence the HUNDREDS lying in thoſe parts are called the *Chiltern Hundreds*.

CHILTERN Hundreds (Stewards of.) Of the Hundreds into which many of the Engliſh counties were divided by King Alfred, for the better government, the juriſdiction was originally veſted in peculiar courts, but came afterwards to be devolved to the county courts; and ſo remains at preſent, excepting with regard to ſome, as the *chilterns*, which have been by privilege annexed to the crown. Theſe having ſtill their own courts, a *Steward* of thoſe courts is appointed by the chancellor of the exchequer, with a ſalary of 20s. and all fees, &c. belonging to the office: And this is deemed an appointment of ſuch profit, as to vacate a ſeat in parliament.

CHIMÆRA, a port-town of Turkey in Europe, ſituated at the entrance of the golph of Venice, in the province of Epirus, about 22 miles north of the city Corfu, near which are the mountains of Chimæra, which divide Epirus from Theſſaly. E. Long. 20. 40. N. Lat. 40. 20.

CHIMÆRA, in fabulous hiſtory, a celebrated monſter, ſprung from Echidna and Typhon. It had three heads; that of a lion, a goat, and a dragon; and continually vomited flames. The foreparts of its body were thoſe of a lion, the middle was that of a goat, and the hinder parts were thoſe of a dragon. It generally lived in Lycia, about the reign of Jobates, by whoſe orders Bellerophon, mounted on the horſe Pegaſus, overcame it. This fabulous tradition is explained by the recollection that there was a burning mountain in Lycia, whoſe top was the reſort of lions on account of its deſolate wilderneſs; the middle, which was fruitful, was covered with goats; and at the bottom the marſhy ground abounded with ſerpents. Bellerophon is ſaid to have conquered the Chimæra, becauſe he deſtroyed the wild beaſts on that mountain, and rendered it habitable. Plutarch ſays that it was the captain of ſome pirates who adorned their ſhip with the images of a lion, a goat, and a dragon.

By a *chimæra*, among the philoſophers, is underſtood a mere creature of the imagination, compoſed of ſuch contradictions and abſurdities as cannot poſſibly any where exiſt but in thought.

CHIMES of a CLOCK, a kind of periodical muſic, produced at equal intervals of time, by means of a particular apparatus added to a clock.

In order to calculate numbers for the chimes, and adapt the chime-barrel, it muſt be obſerved, that the barrel muſt turn round in the ſame time that the tune it is to play requires in ſinging. As for the chime-barrel, it may be made up of certain bars that run athwart it, with a convenient number of holes punched in them to put in the pins that are to draw each hammer: and theſe pins, in order, to play the time of the tune rightly, muſt ſtand upright, or hang down from the bar, ſome more, ſome leſs. To place the pins rightly, you may proceed by the way of changes on bells, viz. 1, 2, 3, 4; or rather make uſe of the muſical notes. Obſerve what is the compaſs of your tune, and divide the barrel accordingly from end to end.

Thus, in the examples on Plate CXXXVII. each of the tunes is eight notes in compaſs; and accordingly the barrel is divided into eight parts. Theſe diviſions are ſtruck round the barrel; oppoſite to which are the hammer-tails.

We ſpeak here as if there were only one hammer to each bell, that it may be more clearly apprehended; but when two notes of the ſame ſound come together in a tune, there muſt be two hammers to the bell to ſtrike it: ſo that if in all the tunes you intend to chime of eight notes compaſs, there ſhould happen to be ſuch double notes on every bell, inſtead of eight you muſt have ſixteen hammers; and accordingly you muſt divide the barrel, and ſtrike ſixteen ſtrokes round it, oppoſite to each hammer-tail: then you are to divide it round about into as many diviſions as there are muſical bars, ſemibreves, minims, &c. in the tune.

Thus the hundredth-pſalm tune has 20 ſemibreves, and each diviſion of it is a ſemibreve: the firſt note of it alſo is a ſemibreve: and, therefore, on the chime-barrel muſt be a whole diviſion, from five to five, as your may underſtand plainly, if you conceive the ſurface of a chime-barrel to be repreſented by the above figures, as if the cylindrical ſuperficies of the barrel were ſtretched out at length, or extended on a plane: and then ſuch a table, ſo divided, if it were to be wrapped round the barrel, would ſhow the places where all the pins are to ſtand in the barrel; for the dots running about the table are the places of the pins that play the tune.

Indeed, if the chimes are to be complete, you ought to have a ſet of bells to the gamut notes; ſo as that each bell having the true ſound of *ſol, la, mi, fa,* you may play any tune with its flats and ſharps: nay, you may by this means play both the baſs and treble with one barrel: and by ſetting the names of your bells at the head of any tune, that tune may eaſily be transferred to the chime-barrel, without any ſkill in muſic; but it muſt be obſerved, that each line in the muſic is three notes diſtant; that is, there is a note between each line, as well as upon it.

CHIMNEY, in architecture, a particular part of a houſe, where the fire is made, having a tube or tunnel to carry off the ſmoke. The word *chimney* comes from the French *cheminee*; and that from the Latin *cuminata*, "a chamber wherein is a chimney:" *caminata*, again, comes from *caminous*; and that from the Greek καμινος, "a chimney;" of καιω, *uro* "I burn."

Chimneys are uſually ſuppoſed a modern invention; the ancients only making uſe of ſtoves: but Octavio Ferrari endeavours to prove chimneys in uſe among the ancients. To this end, he cites the authority of Virgil,

Et jam ſumma procul villarum culmina fumant:

and that of Appian, who ſays, "That of thoſe perſons proſcribed by the triumvirate, ſome hid themſelves in wells and common ſewers, and ſome on the tops of houſes and chimneys;" for ſo he underſtands καπνωδεις υπωροφιας, *fumaria ſub tecto poſita*. Add, that Ariſtophanes, in one of his comedies, introduces his old man, Polycleon, ſhut up in a chamber, whence he endeavours to make his eſcape by the *chimney*. However, the few inſtances remaining among the ancients, together with the obſcurity of the rules of Vitruvius on this head, make us rather conclude the uſe of ſtoves, whereof the ancients had entire apartments, induced them to neglect this part of building which the coldneſs of our climates obliges us to have a principal regard to.

Method of Building CHIMNEYS *that will not ſmoke.* Workmen have different methods of drawing up the funnels of chimneys, generally according to their own fancies and judgements, and ſometimes according to the cuſtoms of places. They are ſeldom directed by ſound and rational principles. It will be found for the moſt part, that the ſmoking of chimneys is owing to their being carried up narrower near the top than below, or zig-zag, all in angles: in ſome caſes, indeed, it is owing to accidental cauſes; but, for the moſt part, to thoſe two abovementioned. Where they are carried up in pyramid or tapering form, eſpecially if the houſe be of a conſiderable height, it is ten to one but they ſometimes ſmoke. The air in the rooms, being rarified, is forced into the funnel of the chimney, and receives from the fire an additional force to carry up the ſmoke. Now, it is evident, that the further up the ſmoke flies, the leſs is the force that drives it, the ſlower it muſt move, and conſequently the more room in proportion it ſhould have to move in; whereas in the uſual way it has leſs, by the ſides of the chimney being gathered cloſer and cloſer together.

The method here propoſed of carrying up chimneys will be objected to by ſome thus: The wider a chimney is at the top, ſay they, the more liberty has the wind to blow down. Very true; but is it not reſiſted in going down, both by the form of the chimney and other evident cauſes, ſo that it muſt return again? In the other way, when the wind blows down, the reſiſtance being leſs, the wind and ſmoke are, if we may uſe the expreſſion, impriſoned, and make the ſmoke puff out below. This method has proved effectual after all others had failed: and that in a houſe placed in the worſt ſituation poſſible, namely, under a high mountain to the ſouthward, from which ſtrong blaſts blow down upon it. A vent was carried up without angles, as perpendicular as poſſible; and was made about three or four inches wider at top than at the bottom: the funnel was gathered in a throat directly above the fire-place, and ſo widening upwards. Since that time the houſe has not only ceaſed to ſmoke, but when the doors ſtand open, the draught is ſo ſtrong that it will carry a piece of paper out at the chimney-head. See more on this ſubject under the article SMOKE.

CHIMNEY-Money, otherwiſe called *Hearth-money*, a duty in England on houſes. By ſtat. 14. Char. II. cap. 2. every fire-hearth, and ſtove of every dwelling or other houſe, within England and Wales (except ſuch as pay not to church and poor), was chargeable with 2 s. *per annum*, payable at Michaelmas and Lady-day to the king and his heirs and ſucceſſors *&c.*; which payment was commonly called *chimney-money*. This tax, being much complained of as burdenſome to the people, has been ſince taken off, and others impoſed in its ſtead; among which that on windows has by ſome been eſteemed almoſt equally grievous.

CHIMPANZEE, in natural hiſtory. See SIMIA.

1
Boundaries Extent, &c.

CHINA, a country of Aſia, ſituated on the moſt eaſterly part of that continent. It is bounded on the north by Tartary; from which it is divided, partly by a prodigious wall of 1500 miles in length, and partly by high, craggy, and inacceſſible mountains. On the eaſt, it is bounded by the ocean; on the weſt, by part of the Mogul's empire, and India beyond the Ganges, from which it is parted by other ridges of high mountains and ſandy deſerts. On the ſouth, it is bounded partly by the kingdoms of Lao, Tonquin, Ava, and Cochin-China, and partly by the ſouthern or Indian ſea, which flows between it and the Philippine iſlands. There are ſeveral ways of computing its length and breadth. According to ſome of theſe, it is reckoned 1268, 1600, or 1800 miles in length, and as much in breadth; however, by the beſt and lateſt accounts, this vaſt country is ſomewhat of an oval form, the breadth being leſs than the length by little more than a fourth-part.

2
Diviſion into provinces.

It contains 15 provinces, excluſive of that of Lyau-tong, which is ſituated without the great wall, though under the ſame dominion. Their names are, 1. Shenſi; 2. Shanſi; 3. Pecheli: which are ſituated on the north ſide, along the wall. 4. Shantong; 5. Kyan-nang; 6. Che-Kyang; 7. Fo-keyn: which are ſituated along the eaſtern ocean. 8. Quangtong: 9. Quangſi; 10. Yu-nan; 11. Se-chuen; which ſtretch themſelves towards the ſouth and ſouth-weſt. And, 12. Ho-nan; 13. Hu-quand; 14. Quey-chew; 15 Kyang-ſi; which take up the middle part. For a particular deſcription of all theſe, ſee their proper articles.

3
Chineſe pretenſions to antiquity.

The origin of all nations is involved in obſcurity and fable; but that of the Chineſe much more ſo than any other. Every nation is inclined to aſſume too high an antiquity to itſelf, but the Chineſe carry theirs beyond all bounds. Indeed, though no people on earth are more exact in keeping records of every memorable

4 Why their hiſtory is ſo uncertain.

morable tranſaction, yet ſuch is the genius of the Chineſe for ſuperſtition and fable, that the firſt part of their hiſtory is deſervedly contemned by every rational perſon. What contributes more to the uncertainty of the Chineſe hiſtory is, that neither we, nor they themſelves, have any thing but fragments of their ancient hiſtorical books; for about 213 years before Chriſt, the reigning emperor of Si-whang-ti cauſed all the books in the empire to be burned, except thoſe written by laywers and phyſicians. Nay, the more effectually to deſtroy the memory of every thing contained in them, he commanded a great number of learned men to be buried alive, leſt, from their memories, they ſhould commit to writing ſomething of the true memoirs of the empire. The inaccuracy of the Chineſe annals is complained of even by their moſt reſpected author, Confucius himſelf; who alſo affirms, that, before his time, many of the oldeſt materials for writing ſuch annals had been deſtroyed.

5 Fabulous hiſtory of China.

According to the Chineſe hiſtories, the firſt monarch of the whole univerſe (that is, of China), was called *Puon-ku*, or *Puen-cu*, This, according to ſome, was the firſt man; but according to Bayer and Menzelius, two of the greateſt critics in Chineſe literature that have hitherto appeared, the word ſignifies *the higheſt antiquity*. Puon-ku was ſucceeded by *Tiene-hoang*, which ſignifies *the emperor of heaven*. They call him alſo the intelligent heaven, the ſupreme king of the middle heaven, *&c.* According to ſome of their hiſtorians, he was the inventor of letters, and of the Cyclic characters by which they determine the place of the year, *&c.* Tiene-hoang was ſucceeded by Ti-hoang (the emperor of the earth), who divided the day and night, appointing 30 days to make one moon, and fixed the winter ſolſtice to the 11th moon. Ti-hoang was ſucceeded by Gine-hoang (ſovereign of men), who with his nine brothers ſhared the government among them. They built cities, and ſurrounded them with walls; made a diſtinction between the ſovereign and ſubjects; inſtituted marriage, *&c.*

The reigns of theſe four emperors make up one of what the Chineſe called *ki*, "ages," or "periods," of which there were nine before Fo-hi, whom their moſt ſenſible people acknowledge as the founder of their empire.

The hiſtory of the ſecond *ki* contradicts almoſt every thing ſaid of the firſt; for though we have but juſt now been told that Gjne-hoang and his brethren built cities ſurrounded with walls; yet, in the ſucceeding age, the people dwelt in caves, or perched upon trees as it were in neſts. Of the third *ki* we hear nothing; and in the fourth, it ſeems matters had been ſtill worſe, as we are told that men were then only taught to retire into the hollows of rocks. Of the fifth and ſixth we have no account. Theſe ſix periods, according to ſome writers, contained 90,000 years; according to others, 1,100,750.

In the ſeventh and eighth *ki*, they tell us over again what they had ſaid of the firſt; namely, that men began to leave their caves and dwell in houſes, and were taught to prepare cloths, *&c.* Tchine-fang, the firſt monarch of the eighth *ki*, tought his ſubject to take off the hair from ſkins with rollers of wood, and cover themſelves with the ſkins ſo prepared. He taught them alſo to make a kind of web of their hair, to ſerve as a covering to their heads againſt rain. They obeyed his orders with joy, and he called his ſubjects *people clothed with ſkins*. His reign laſted 350 years; that of one of his ſucceſſors, alſo, named Yeou-tſao-chi, laſted more than 300; and his family continued for 12 or 18,000 years. But what is very ſurpriſing, all theſe thouſands and millions of years had elapſed without mankind's having any knowledge of fire. This was not diſcovered till towards the cloſe of this period, by one Souigine. After ſo uſeful a diſcovery, he taught the people to dreſs their victuals; whereas before, they had devoured the fleſh of animals quite raw, drank their blood, and ſwallowed even their hair and feathers. He is alſo ſaid to have been the inventor of fiſhing, letters, *&c.*

In the ninth period we find the invention, or at leaſt the origin of letters, attributed to one Tſang-hic, who received them from a divine tortoiſe that carried them on his ſhell, and delivered them into the hands of Tſang-hic. During this period alſo, muſic, money, carriages, merchandize, and commerce, *&c.* were invented. There are various calculations of the length of theſe *ki* or periods. Some make the time from Puon-ku to Confucius, who flouriſhed about 479 years before Chriſt, to contain 279,000 years; others, 2,276,000; ſome, 2,759,860 years; others, 3,276,000; and ſome no leſs than 96,961,740 years.

6 Fabulous hiſtory explained.

Theſe extravagant accounts are by ſome thought to contain obſcure and imperfect hints concerning the coſmogony and creation of the world, *&c.* Puon-ku, the firſt emperor, they think, repreſents eternity preceding the duration of the world. The ſucceeding ones, Tiene-hoang, Ti-hoang, and Gine-hoang, they imagine, ſignify the creation of the heavens and earth, and the formation of man. The ten *ki*, or ages, nine of which preceded Fo-hi, mean the ten generations preceding Noah. This may very poſſibly be the caſe; for about 300 years before Chriſt, ſome Jews travelled into China, who might have made the Moſaic writings known there.

7 Reign of Fo-hi.

What we have now related, contains the ſubſtance of that part of the Chineſe hiſtory which is entirely fabulous. After the nine *ki* or "ages" already taken notice of, the tenth commenced with Fo-hi; and the hiſtory, though ſtill very dark, obſcrue, and fabulous, begins to grow ſomewhat more conſiſtent and intelligible. Fo-hi was born in the province of Shenſi. His mother walking upon the banks of a lake in that province, ſaw a very large print of a man's foot in the ſand there; and, being ſurrounded by an iris or rainbow, became impregnated. The child was named *Fo-hi*; and, when he grew up, was by his countrymen elected king on account of his ſuperior merit, and ſtyled *Tyent-tſe*, that is "the ſon of heaven." He invented the eight *qua*, or ſymbols, conſiſting of three lines each, which, differently combined, formed 64 characters that were made uſe of to expreſs every thing. To give theſe the greater credit, he pretended that he had ſeen them inſcribed on the back of a dragon-horſe (an animal ſhaped like a horſe, with the wings and ſcales of a dragon), which aroſe from the bottom of a lake. Having gained great reputation among his countrymen by this prodigy, he is ſaid to have created mandarins or officers, under the name of *dragons*. Hence we may aſſign a reaſon why the emperors of China always carry a dragon in their banners. He alſo inſtituted marriage, invented muſic, *&c.* Having eſtabliſhed a prime miniſter, he divided the government of his dominions among four mandarins, and died after a reign of 115 years.

8 Miraculous ſolſtice.

After Fo-hi followed a ſucceſſion of emperors, of whom nothing remarkable is recorded, except that in the reign of *Yau*, the ſeventh after Fo-hi, the ſun did not ſet for ten days, ſo that the Chineſe were afraid of a general conflagration. This event the compilers of the Univerſal Hiſtory take to be the ſame with that mentioned in the book of Joſhua, when the ſun and moon ſtood ſtill for about the ſpace of a day. Fo-hi, they will have to be the ſame with Noah. They imagine, that after the deluge, this patriarch remained ſome time with his deſcendents; but on their wicked combination to build the tower of Babel, he ſeparated himſelf from them with as many as he could perſuade to go along with him; and that, ſtill travelling eaſtward, he at laſt entered the fertile country of China, and laid the foundation of that vaſt empire—But, leaving theſe fabulous and conjectured times, we ſhall proceed to give ſome account of that part of the Chineſe hiſtory, which may be more certainly depended on.

9 Hypotheſis concerning this ſolſtice and Fo-hi.

As the Chineſe, contrary to the practice of almoſt all nations, have never ſought to conquer other countries, but rather to improve and content themſelves with their own, their hiſtory for many ages furniſhes nothing remarkable. The whole of their emperors, abſtracting from thoſe who are ſaid to have reigned in the fabulous times, are comprehended in 22 dynaſties, mentioned in the following table.

	Emperors.	Before Chriſt.
1. *Hya*, containing	16	2207.
2. *Shang*, or *Ing*,	28	1766.
3. *Chew*,	35	1122.
4. *Tſin*,	4	248.
5. *Han*,	25	206.
		After Chriſt.
6. *Hew-han*,	2	220.
7. *Tſin*,	15	465.
8. *Song*,	8	220.
9. *Tſi*,	5	479.
10. *Lyang*,	4	502.
11. *Chin*,	4	557.
12. *Swi*,	3	
13. *Twand*,	20	618.
14. *Hew-lyang*,	2	907.
15. *Hew-tang*,	4	903.
16. *Hewtſin*,	2	936.
17. *Hew-han*,	4	947.
18. *Hew-chew*,	3	951.
19. *Song*,	18	960.
20. *Iwen*,	9	1280.
21. *Ming*,	16	1368.
22. *Tſing*,		1645.

This table is formed according to the account of the Jeſuit Du Halde, and is commonly reckoned to be the moſt authentic; but according to the abovementioned hypotheſis of the compilers of the Univerſal Hiſtory, who make *Yau* contemporary with Joſhua, the dynaſty of *Hya* did not commence till the year before Chriſt 1057; and to accommodate the hiſtory to their hypotheſis, great alterations muſt be made in the duration of the dynaſties.

10 Incurſions of the tartars.

The moſt intereſting particulars of the Chineſe hiſtory relate only to the incurſions of the Tartars, who at laſt conquered the whole empire, and who ſtill continue to hold the ſovereignty; though by transferring the ſeat of the empire to Peking, and adopting the Chineſe language, manners, *&c.* Tartary would ſeem rather to have been conquered by China, than China by Tartary. Theſe incurſions are ſaid to have begun very early; even in the time of the emperor Shun, ſucceſſor to Yau abovementioned, in whoſe reign the miraculous ſolſtice happenned. At this time, the Tartars were repulſed, and obliged to retire into their own territories. From time to time, however, they continued to threaten the empire with invaſions, and the northern provinces were often actually ravaged by the Tartars in the neighbourhood. About the year before Chriſt 213, Shi-whang-ti, having fully ſubdued all the princes, or kings, as they were called, of the different provinces, became emperor of China with unlimited power. He divided the whole empire into 36 provinces; and finding the northern part of his dominions much incommoded by the invaſions of the neighbouring barbarians, he ſent a formidable army againſt them, which drove them far beyond the boundaries of China. To prevent their return, he built the famous wall already mentioned, which ſeparates China from Tartary. After this, being elated with his own exploits, he formed a deſign of making poſterity believe that he himſelf had been the firſt Chineſe emperor that ever ſat on the throne. For this purpoſe, he ordered all the hiſtorical writings to be burnt, and cauſed many of the learned to be put to death, as already mentioned.

11 Great wall built.

What effect the great wall for ſome time had in preventing the invaſions of the Tartars, we are not told; but in the tenth century of the Chriſtian aera, thoſe of Kitan or Lyau got a footing in China. The Kitan were a people of eaſtern Tartary, who dwelt to the north and north-eaſt of the province of Pecheli in China, particularly in that of Lyau-tong lying without the great wall. Theſe people having ſubdued the country between Korea and Kaſhgar, became much more troubleſome to the Chineſe than all the other Tartars. Their empire commenced about the year 916, in the fourth year of Mo-ti-kyan-ti, ſecond emperor of the 14th Chineſe dynaſty called *Hew-lyang*. In 946, Mingt-ſong, ſecond emperor of the 15th dynaſty, being dead, Sheking-tang, his ſon-in-law, rebelled againſt Mingt-ſong, his ſon and ſucceſſor, whom he deprived of his crown and life. This he accompliſhed by means of an army of 50,000 men furniſhed by the Kitan. Fi-ti, the ſon of Mingt-Song, being unable to reſiſt the uſurper, fled to the city Ghey-chew; where ſhutting himſelf up with his family and all his valuable effects, he ſet fire to the palace, and was burnt to aſhes. On his death, Sheking-tang aſſumed the title of emperor; founded the 16th dynaſty; and changed his name to that of *Kaut-ſu*. But the Kitan general refuſing to acknowledge him, he was obliged to purchaſe

12 Kitan Tartars ſettle in China.

chaſe a peace by yielding up to the Tartars 16 cities in the province of Pecheli, beſides a yearly preſent of 300,000 pieces of ſilk.

This ſubmiſſion ſerved only to inflame the avarice and ambition of the Kitan. In 959, they broke the treaty when leaſt expected, and invaded the empire afreſh. Tſi-vang, the emperor at that time, opppoſed them with a formidable army: but through the treachery of his general Lyew-chi-ywen, the Tartars were allowed to take him priſoner. On this, Tſi-vang was glad to recover his liberty by accepting of a ſmall principality; while the traitor became emperor of all China, and, changing his name to *Kaut-ſu*, founded the 17th dynaſty. The Tartars, in the mean time, ravaged all the northern provinces without oppoſition, and then marched into the ſouthern. But being here ſtopped by ſome bodies of Chineſe troops, the general thought proper to retire with his booty into Tartary. In 962, Kaut-ſu, dying, was ſucceeded by his ſon In-ti. The youth of this prince gave an opportunity to the eunuchs to raiſe commotions; eſpecially as the army was employed at a diſtance in repelling the invaſions of the Tartars. This army was commanded by Ko-ghey, who defeated the enemy in ſeveral battles, and thus reſtored peace to the northern provinces. In the mean time, In-ti was ſlain by his eunuchs, and the empreſs placed his brother on the throne: but Ko-ghey, returning in triumph, was ſaluted emperor by his victorious army, and the empreſs being unable to ſupport the rights of her ſon, was obliged to ſubmit, while Ko-ghey, aſſuming the name of *Tay-tſu*, founded the 18th dynaſty. Nine years after this, however, the grandees of the empire, ſetting aſide Kong-ti, the third in ſucceſſion from Tay-tſu, on account of his non-age, proclamed his guardian, named *Chau-quang-yu*, emperor; who aſſuming the name of Kau-tſu, founded the 19th dynaſty, called *Song*, or *Tſong*.

Under this monarch the empire began to recover itſelf; but the Kitan ſtill continued their incurſions. The ſucceſſors of Kau-tſu, oppoſed them with various ſucceſs; but at laſt, in 978, the barbarians became ſo ſtrong as to lay ſiege to a conſiderable city. Tay-tſong, ſucceſſor to Kau-tſu, detached 3000 ſoldiers, each carrying a light in his hand, againſt them in the night-time, with orders to approach as near as poſſible to the Tartar camp. The barbarians imagining by the number of lights, that the whole Chineſe army was at hand, immediately fled, and falling into the ambuſcades laid for them by the Chineſe general, were almoſt all cut to pieces.

This check, however, did not long put a ſtop to the ravages of the Kitan. In the year 999, they laid ſiege to a city in the province of Peche-li: but Ching-tſong, ſucceſſor to Tay-tſong, came upon them with his army ſo ſuddenly, that they betook themſelves to flight. The emperor was adviſed to take advantage of their conſternation, and recover their country which had been yielded to them: but inſtead of purſuing his victory, he bought a peace, by conſenting to pay annually 100,000 tael (about L.34,000), and 200,000 pieces of ſilk. The youth and pacific diſpoſition of Jin-tſong, ſucceſſor to Ching-tſong, revived the courage of the Kitan; and, in 1035, war would have been renewed, had not the emperor condeſcended to as ſhameful a treaty as that concluded by his father. Two years after, the Tartars demanded reſtitution of ten cities in the province of Peche-li, which had been taken by Ko-ghey founder of the 18th dynaſty; upon which Jin-tſong engaged to pay them an annual tribute of 200,000 taels of ſilver, and 300,000 pieces of ſilk in lieu of theſe cities.

13
Kitan driven out by the eaſtern Tartars.

From this time the Kitan remained in peaceable poſſeſſion of their Chineſe dominions till the year 1117. Whey-tſong, at that time emperor, being able neither to bear their ravages, nor by himſelf to put a ſtop to them, reſolved upon a remedy which at laſt proved worſe than the diſeaſe. This was to call in the Nu-che, Nyu-che, or Eaſtern Tartars, to deſtroy the kingdom of the Kitan. From this he was diſſuaded by the king of Korea, and moſt of his own miniſters; but, diſregarding their ſalutary advice, he joined his forces to thoſe of the Nu-che. The Kitan were then every where defeated; and at laſt reduced to ſuch extremity, that thoſe who remained were forced to leave their country, and fly to the mountains of the weſt.

14
Who aſſume the name of *Kin*, and invade China.

Thus the empire of the Kitan was totally deſtroyed, but nothing to the advantage of the Chineſe; for the Tartar general, elated with his conqueſt, gave the name of *Kin* to his new dominion, aſſumed the title of emperor, and began to think of aggrandizing himſelf and enlarging his empire. For this purpoſe, he immediately broke the treaties concluded with the Chineſe emperor; and invading the provinces of Peche-li and Shen-ſi, made himſelf maſter of the greater part of them. Whey-tſong, finding himſelf in danger of loſing his dominions, made ſeveral advantageous propoſals to the Tartar; who, ſeeming to comply with them, invited him to come and ſettle matters by a perſonal conference. The Chineſe monarch complied: but, on his return, the terms agreed on ſeemed intolerable to his miniſters; ſo that they told him the treaty could not ſubſiſt, and that the moſt cruel war was preferable to ſuch an ignominious peace. The Kin monarch, being informed of all that paſſed, had recourſe to arms, and took ſeveral cities. Whey-tſong was weak enough to go in perſon to hold a ſecond conference; but, on his arrival, was immediately ſeized by the Tartar. He was kept priſoner under a ſtrong guard during the remaining part of his life; and ended his days in 1126, in the deſert of Shamo, having nominated his eldeſt ſon Kin-tſong to ſucceed him.

15
They take the emperor priſoner.

Kin-tſong began his reign with putting to death ſix miniſters of ſtate, who had betrayed his father into the hands of the Kin Tartars. The barbarians in the mean time purſued their conqueſts without oppoſition. They croſſed the Whang-ho, or Yellow River, which an handful of troops might have prevented; and marching directly towards the imperial city, took and plundered it. Then ſeizing the emperor and his conſort, they carried them away captives: but many of the principal lords, and ſeveral of the miniſters, preferring death to ſuch an ignominious bondage, killed themſelves. The Kin being informed by the empreſs *Meng* that ſhe had been divorced, they left her behind. This proved the means of ſaving the empire: for

16
Imperial city and another emperor taken.

for by her wiſdom and prudence ſhe got the crown placed on the head of Kau-tſong, ninth ſon of the emperor Whey-tſong by his divorced empreſs.

Kau-tſong fixed his court at Nanking the capital of Kyang-nan; but ſoon after was obliged to remove it to Kang-chew in Che-kyang. He made ſeveral efforts to recover ſome of his provinces from the Kin, but without effect. Hi-tſong the Kin monarch, in the mean time, endeavoured to gain the eſteem of his Chineſe-ſubjects by paying a regard to their learning and learned men, and honouring the memory of Confucius. Some time after, he advanced to Nanking, from whence Kau-tſong had retired, and took it: but, receiving advice that Yo-ſi, general of the Song, or ſouthern Chineſe, was advancing by long marches to the relief of that city, they ſet fire to the palace, and retired northward. However, Yo-ſi arrived time enough to fall upon their rear-guard; which ſuffered very much; and from this time the Kin never dared to croſs the river Kyang. In a few years afterwards the Chineſe emperor ſubmitted to become tributary to the Kin, and concluded a peace with them upon very diſhonourable terms. This ſubmiſſion, however, was of little avail: for, in 1163, the Tartars broke the peace; and, invading the ſouthern province with a formidable army, took the city of Yang-chew. The king, having approached the river Kyang, near its mouth, where it is wideſt as well as moſt rapid, commanded his troops to croſs it, threatening, with his drawn ſword to kill thoſe who refuſed. On receiving ſuch an unreaſonable command, the whole army mutinied; and the king being killed in the beginning of the tumult, the army immediately retired.

17
Progreſs the Kin checked.

18
They are attacked by Jenghiz khan and the king of Hya.

From this time to the year 1210, nothing remarkable occurs in the Chineſe hiſtory; but this year, Jenghiz-khan, chief of the weſtern Tartars, *Moguls*, or *Mungls*, quarrelled with Yong-tſi emperor of the Kin; and at the ſame time the king of Hya, diſguſted at being refuſed aſſiſtance againſt Jenghiz-khan, threatened him with an invaſion on the weſt ſide. Yong-tſi prepared for his defence; but in 1211, receiving news that Jenghiz-khan was advancing ſouthward with his whole army, he was ſeized with fear, and made propoſals of peace, which were rejected. In 1212, the Mogul generals forced the great wall; or, according to ſome writers, had one of the gates treacherouſly opened to them, to the north of Shanſi; and made incurſions as far as Peking the capital of the Kin empire. At the ſame time the province of Lyau-tong was almoſt totally reduced by ſeveral Kitan lords who had joined Jenghiz-khan; ſeveral ſtrong places were taken, and an army of 300,000 Kin defeated by the Moguls. In autumn they laid ſiege to the city of Tay-tong-fu; where, although the governor Hujaku fled, yet Jenghiz-khan met with a conſiderable reſiſtance. Having loſt a vaſt number of men, and being himſelf wounded by an arrow, he was obliged to raiſe the ſiege and retire into Tartary; after which the Kin retook ſeveral cities. The next year, however, Jenghiz-khan re-entered China; retook the cities which the Kin had reduced the year before; and overthrew their armies in two bloody battles, in one of which the ground was ſtrewed with dead bodies for upwards of four leagues.

19
Great wall forced by Jenghiz-khan.

The ſame year Yong-tſi was ſlain by his general Hujaku; and Sun, a prince of the blood, advanced in his room. After this the Moguls, attacking the empire with four armies at once, laid waſte the provinces of Shanſi, Honan, Pecheli, and Shantong. In 1214 Jenghiz-khan ſat down before Peking; but inſtead of aſſaulting the city, offered terms of peace, which were accepted, and the Moguls retired into Tartary. After their departure, the emperor, leaving his ſon at Peking, removed his court to Pyen-lyang near Kay-fong-fu, the capital of Honan. At this Jenghiz-khan being offended, immediately ſent troops to beſiege Peking. The city held out to the fifth month of the year 1215, and then ſurrendered. At the ſame time the Moguls finiſhed the conqueſt of Lyau-tong; and the Song refuſed to pay the uſual tribute to the Kin.

20
Peking taken.

21
Southern Chineſe declared war againſt the Kin.

In 1216, Jenghiz-khan returned to purſue his conqueſts in the weſt of Aſia, where he ſtaid ſeven years; during which time his general Muhuli made great progreſs in China againſt the Kin emperor. He was greatly aſſiſted by the motions of Ning-tſong emperor of the Song, or ſouthern China; who, incenſed by the frequent perfidies of the Kin, had declared war againſt them, and would hearken to no terms of peace, though very advantageous propoſals were made. Notwithſtanding this, however, in 1220, the Kin, exerting themſelves raiſed two great armies, one in Shenſi, and the other in Shang-ton. The former baffled the attempts of the Song and king of Hya, who had united againſt them; but the latter, though no fewer than 200,000, were entirely defeated by Muhuli. In 1221, that officer paſſed the Whang-ho, and died after conquering ſeveral cities.

22
Jenghiz-khan deſtroys the kingdom of Hya;

In 1224, the Kin emperor died; and was ſucceeded by his ſon Shew, who made peace with the king of Hya: but next year, that kingdom was entirely deſtroyed by Jenghiz-khan. In 1226, Oktay ſon to Jenghiz-khan marched into Honan, and beſieged Kay-Song fu, capital of the Kin empire; but was obliged to withdraw into Shenſi, where he took ſeveral cities, and cut in pieces an army of 30,000 men. In 1227 Jenghiz-khan died, after having deſired his ſons to demand a paſſage for their army through the dominions of the Song, without which he ſaid they could not eaſily vanquiſh the Kin.

23
And dies.

After the death of that great conqueror, the war was carried on with various ſucceſs; but though the Moguls took above 60 important poſts in the province of Shenſi, they found it impoſſible to force Tong-quan, which it behoved them to do in order to penetrate effectually into Honan. In April 1231 they took the capital of Shenſi, and defeated the Kin army which came to its relief. Here one of the officers deſired prince Toley to demand a paſſage from the Song through the country of Han chong-fu. This propoſal Toley communicated to his brother Oktay, who approved of it as being conformable to the dying advice of Jenghiz-khan. Hereupon Toley, having aſſembled all his forces, ſent a meſſenger to the Song generals to demand paſſage through their territories. This, however, they not only refuſed, but put the meſſenger to death; which ſo enraged Toley that he ſwore to make them repent of it, and was ſoon as good as his word. He decamped in Auguſt 1231, and having forced the paſſages, put to the ſword the inhabitants of

24
Moguls quarrel with the Song.

25
Exploits of Toley.

Wha-yang and Fong-chew, two cities in the diſtrict of Han-chong-fu. Then having cut down rocks to fill up deep abyſſes, and made roads through places almoſt inacceſſible, he came and beſieged the city of Han-chong-fu itſelf. The miſerable inhabitants fled to the mountains on his approach, and more than 100,000 of them periſhed. After this, Toley divided his forces, conſiſting of 30,000 horſe, into two bodies. One of theſe went weſtward to Myen-chew: from thence, after opening the paſſages of the mountains, they arrived at the river Kyaling, which runs into the great Kyang. This they croſſed on rafts made of the wood of demoliſhed houſes; and then, marching along its banks, ſeized many important poſts. At laſt, having deſtroyed more than 140 cities, towns, or fortreſſes, they returned to the army. The ſecond detachment ſeized an important poſt in the mountains, called *Tautong*, ſix or ſeven leagues to the eaſtward of Han-chong-fu. On the other ſide Oktay advanced, in October, towards Pu-chew a city of Shan-ſi; which being taken after a vigorous defence, he prepared to paſs the Whang-ho. Toley, after ſurmounting incredible difficulties, arrived in December on the borders of Honan, and made a ſhew as if he deſigned to attack the capital of the Kin empire. On his firſt appearance in Honan through a paſſage ſo little ſuſpected, every body was filled with terror and aſtoniſhment, ſo that he proceeded for ſome time without oppoſition. At laſt the emperor ordered his generals, Hota, Ilapua, and others, to march againſt the enemy. Toley boldly attacked them; but was obliged to retire, which he did in good order. Hota was for purſuing him, ſaying that the Mogul army did not exceed 30,000 men, and that they ſeemed not to have eaten any thing for two or three days. Ilapua, however, was of opinion that there was no occaſion for being ſo haſty, as the Moguls were incloſed between the rivers Han and Whang-ho, ſo that they could not eſcape. This negligence they ſoon had occaſion to repent of: for Toley, by a ſtratagem, made himſelf maſter of their heavy baggage; which accident obliged them to retire to Tang-chew. From thence they ſent a meſſenger to acquaint the emperor that they had gained the battle, but concealed the loſs of their baggage. This good news filled the court with joy; and the people who had retired into the capital for its defence, left it again, and went into the country; but, in a few days after, the vanguard of the Moguls, who had been ſent by the emperor Oktay, appeared in the field, and carried off a great number of thoſe that had quitted the city.

26
Capital of the Kin empire beſieged.

In January 1232, Oktay paſſing the Whang-ho, encamped in the diſtrict of Kay-fong-fu, capital of the Kin empire, and ſent his general Suputay to beſiege the city. At that time the place was near 30 miles in circumference: but having only 40,000 ſoldiers to defend it, as many more from the neighbouring cities, and 20,000 peaſants, were ordered into it; while the emperor publiſhed an affecting declaration, animating the people to defend it to the laſt extremity. Oktay, having heard with joy of Toley's entrance into Honan, ordered him to ſend ſuccours to Suputay. On the other hand, the Kin generals advanced with 150,000 men to relieve the city; but being obliged to divide their forces in order to avoid in part the great road which Toley had obſtructed with trees, they were attacked by that prince at a diſadvantage, and, after a faint reſiſtance, defeated with great ſlaughter, and the loſs of both their generals, one killed and the other taken. The emperor now ordered the army at Tong-quan and other fortified places to march to the relief of Kay-fong-fu. They aſſembled accordingly, to the number of 110,000 foot and 15,000 horſe; and were followed by vaſt numbers of people who expected by their means to be protected from the enemy. But many of theſe troops having deſerted, and the reſt being enfeebled by the fatigues of their march, they diſperſed on the approach of their purſuers, who killed all they found in the highways. After this the Moguls took Tong-quan and ſome other conſiderable poſts; but were obliged to raiſe the ſieges of Quey-te-fu and Loyang, by the bravery of the governors. Kyang-ſhin, governor of Loyang, had only 3 or 4000 ſoldiers under him, while his enemies were 30,000 ſtrong. He placed his worſt ſoldiers on the walls, putting himſelf at the head of 400 brave men; whom he ordered to go naked, and whom he led to all dangerous attacks. He invented engines to caſt large ſtones, which required but few hands to play them, and aimed ſo true as to hit at 100 paces diſtance. When their arrows failed, he cut thoſe ſhot by the enemy into four pieces; pointed them with pieces of braſs coin; and diſcharged them from wooden tubes with as much force as bullets are from a muſket. Thus he haraſſed the Moguls for three months ſo grievouſly, that they were obliged, notwithſtanding their numbers, to abandon the enterprize.

27
Bravery of the beſieged.

Oktay, at laſt, notwithſtanding his ſucceſſes, reſolved to return to Tartary; and offered the Kin emperor peace, provided he became tributary, and delivered up to him 27 families which he named. Theſe offers were very agreeable to the emperor; but Suputay, taking no notice of the treaty, puſhed on the ſiege of the capital with more vigour than ever. By the help of the Chineſe ſlaves in his army, the Mogul general ſoon filled the ditch; but all his efforts ſeemed only to inſpire the beſieged with new vigour. The Moguls at that time made uſe of artillery, but were unable to make the leaſt impreſſion upon the city walls. They raiſed walls round thoſe they beſieged, which they fortified with ditches, towers, and battlements. They proceeded alſo to ſap the walls of the city; but were very much annoyed by the artillery of the beſieged, eſpecially by their bombs, which ſinking into the galleries, and burſting under ground, made great havock among the miners. For 16 days and nights the attack continued without intermiſſion; during which time an incredible number of men periſhed on both ſides: at length, Suputay, finding that he could not take the city, withdrew his troops, under pretence of conferences being on foot. Soon after, the plague began in Kay-fong-fu; and raged with ſuch violence, that in 50 days, 900,000 biers were carried out, beſides a vaſt multitude of the poorer ſort who could not afford any.

28
Peace concluded;

29
And broken.

In a ſhort time, two unlucky accidents occaſioned a renewal of the war; which now put an end to the empire of the Kin. Gan-yong, a young Mogul lord, having aſſumed the government of ſome cities in Kyang-nan, and killed the officer ſent to take poſſeſſion of them, declared for the Kin. The emperor unwarily took Gan-yong into his ſervice, and gave him the title of Prince. Upon this Oktay ſent an envoy, attended by 30 other perſons, to inquire into the affair; but the Kin officers killed them all, without being puniſhed by the emperor. Suputay, having informed his maſter of all theſe proceedings, was ordered to continue the war in Honan. Shew-fu now commanded his officers to unite their troops for the defence of the capital; but before his orders could be obeyed, they were attacked and defeated, one after another, by the Moguls. This obliged him to raiſe ſoldiers from among the peaſants, for whoſe ſubſiſtence the people were taxed $\frac{3}{10}$ of the rice they poſſeſſed. The city began now to be diſtreſſed for want of proviſions; and as it was but in a bad poſture of defence, the emperor marched with an army againſt the Moguls. His expedition proved unfortunate; for, ſending part of his army to beſiege a city called Why-chew, it was totally cut in pieces, and Suputay a ſecond time ſat down before the capital.

30
Capital again beſieged,

31
And taken.

On hearing this bad news, the emperor repaſſed the Whang-ho, and retired to Quey-te-fu. Here he had not been long before the capital was delivered up by treachery, and Suputay put all the males of the imperial race to death; but, by the expreſs command of Oktay, ſpared the inhabitants, who are ſaid to have amounted to 1,400,000 families. After this diſaſter the unhappy monarch left his troops at Quey-te-fu, and retired to Juning-fu, a city in the ſouthern part of Honan, attended only by 400 perſons. Here the diſtance of the Moguls made him think of living at eaſe; but while he flattered himſelf with theſe vain hopes; the enemy's army arrived before the city and inveſted it. The garriſon were terrified at their approach; but were encouraged by the emperor, and his brave general Hu-ſye-hu, to hold out to the laſt. As there were not in the city a ſufficient number of men, the women, dreſſed in mens clothes, were employed to carry wood, ſtones, and other neceſſary materials to the walls. All their efforts, however, were ineffectual. They were reduced to ſuch extremities, that for three months they fed on human fleſh; killing the old and feeble, as well as many priſoners, for food. This being known to the Moguls, they made a general aſſault in January 1234. The attack continued from morning till night: but at laſt the aſſailants were repulſed. In this action, however, the Kin loſt all their beſt officers; upon which the emperor reſigned the crown to Cheng-lin a prince of the blood. Next morning, while the ceremony of inveſting the new emperor was performing, the enemy mounted the ſouth walls, which were defended only by 200 men; and the ſouth gate being at the ſame time abandoned, the whole army broke in. They were oppoſed, however, by Hu-ſye-hu; who, with 1000 ſoldiers, continued to fight with amazing intrepidity. In the mean time Shew-fu, ſeeing every thing irreparably loſt, lodged the ſeal of the empire in a houſe; and then cauſing ſheaves of ſtraw to be ſet round it, ordered it to be ſet on fire as ſoon as he was dead. After giving this order he hanged himſelf, and his commands were executed by his domeſtics. Hu-ſye-hu, who ſtill continued fighting with great bravery, no ſooner heard of the tragical death of the emperor than he drowned himſelf in the river Ju; as did alſo 500 of his moſt reſolute ſoldiers. The ſame day the new emperor, Cheng-lin, was ſlain in a tumult; and thus an end was put to the dominion of the Kin Tartars in China.

32
Siege of Juning-fu.

33
Unhappy fate of the emperor.

34
Diſſolution of the Kin empire.

The empire of China was now to be ſhared between the Song, or Southern Chineſe, and the Moguls. It had been agreed upon, that the province of Honan ſhould be delivered up to the Song as ſoon as the war was finiſhed. But they, without waiting for the expiration of the term, or giving Oktay notice of their proceedings, introduced their troops into Kay-fong-fu, Lo-yang, and other conſiderable cities. On this the Mogul general reſolved to attack them; and repaſſing the Whang-ho, cut in pieces part of the garriſon of Lo-yang, while they were out in ſearch of proviſions. The garriſon of Kay-fong-fu likewiſe abandoned that place; and the Song emperor degraded the officers who had been guilty of thoſe irregularities, ſending ambaſſadors to Oktay, at the ſame time, to deſire a continuance of the peace. What Oktay's anſwer was we are not told, but the event ſhowed that he was not well pleaſed; for, in 1235, he ordered his ſecond ſon prince Kotovan, and his general Chahay, to attack the Song in Se-chwen, while others marched towards the borders of Kyang-nan.

35
War between the Song and the Moguls.

In 1236, the Moguls made great progreſs in the province of Hu-quang, where they took ſeveral cities, and put vaſt numbers to the ſword. This year they introduced paper or ſilk money, which had formerly been uſed by Chang-tſong ſixth emperor of the Kin. Prince Kotovan forced the paſſages into the diſtrict of Hang-chong-fu in the province of Shenſi, which he entered with an army of 500,000 men. Here a terrible battle was fought between the vaſt army of the Moguls and the Chineſe troops, who had been driven from the paſſages they defended. The latter conſiſted only of 10,000 horſe and foot, who were almoſt entirely cut off; and the Moguls loſt ſuch a number of men, that the blood is ſaid to have run for two leagues together. After this victory the Moguls entered Sechwen, which they almoſt entirely reduced, committing ſuch barbarities, that, in one city, 40,000 people choſe rather to put an end to their own lives than ſubmit to ſuch cruel conquerors.

36
Dreadful engagement.

In 1237, the Moguls received a conſiderable check before the city of Gan-tong in Kyang-nan, the ſiege of which they were obliged to raiſe with loſs. In 1238 they beſieged Lu-chew, another city in the ſame province. They ſurrounded it with a rampart of earth and a double ditch; but the Chineſe general ordered their intrenchments to be filled with immenſe quantities of herbs ſteeped in oil, and then ſet on fire, while he ſhot ſtones upon them from a tower ſeven ſtories high. At the ſame time a vigorous ſally was made; and the Mogul army being thrown into the utmoſt diſorder, were obliged finally to abandon the ſiege and retire northwards.

In 1239, theſe barbarians were oppoſed by a general called Meng-kong, with great ſucceſs; who, this and the following year, gained great honour by his exploits. While he lived, the Moguls were never able to make any conſiderable progreſs; but his death, in 1246, proved of the greateſt detriment to the Chineſe affairs; and ſoon after, the Tartars renewed the war with more vigour and ſucceſs than ever. In

1225, they re-entered the province of Se-chwen; but ſtill met with vigorous oppoſition in this quarter, becauſe the Chineſe took care to have Se-chwen furniſhed with good troops and generals. Though they were always beaten, being greatly inferior in number to their enemies, yet they generally retook the cities the Moguls had reduced, as the latter were commonly obliged to withdraw for want of proviſions and forage.

37
Siege of Ho-chew.

In 1259 they undertook the ſiege of Ho-chew, a ſtrong city to the weſt of Peking, defended by Vang-kyen, a very able officer, who commanded a numerous garriſon. The ſiege continued from the month of February till Auguſt; during which time the Moguls loſt an immenſe number of men. On the 10th of Auguſt they made a general aſſault in the night. They mounted the walls before the governor had intelligence; but were ſoon attacked by him with the utmoſt fury. The Mogul emperor, Meng-ko, himſelf came to the ſcalade; but his preſence was not ſufficient to overcome the valour of Vang-kyen.

38
Moguls defeated and their emperor killed.

At the ſame time the ſcaling-ladders of the Moguls were blown down by a ſtorm; upon which a terrible ſlaughter enſued, and among the reſt fell the emperor himſelf. Upon this diſaſter the Mogul generals agreed to raiſe the ſiege, and retire towards Shen-ſi.

On the death of Meng-ko, Hupilay, or Kublay Khan, who ſucceeded him, laid ſiege to Vu-chang-fu, a city not far diſtant from the capital of the Song empire.

At this the emperor being greatly alarmed, diſtributed immenſe ſums among his troops; and, having raiſed a formidable army, marched to the relief of Vu-chang-fu. Unfortunately the command of this army was committed to the care of Kya-tſe-tau, a man without either courage or experience in war. He was beſides very vain and vindictive in his temper; often uſing the beſt officers ill, and entirely overlooking their merit, which cauſed many of them to go over to the Moguls. The ſiege of Vu-chang-fu was commenced, and had continued a conſiderable time, when Kya-tſe-tau, afraid of its being loſt, and at the ſame time not daring to take any effectual ſtep for its relief, made propoſals of peace. A treaty was accordingly concluded, by which Kya-tſe-tau engaged to pay an annual tribute of about L.50,000 in ſilver, and as much in ſilk; acknowledging likewiſe the ſovereignty of the Moguls over the Song empire. In conſequence of this treaty, the Moguls retreated after the boundaries of the two empires had been fixed, and repaſſed the Kyang; but 170 of them having ſtaid on the other ſide of the river, were put to death by Kya-tſe-tau.

39
Treachery of a Chineſe miniſter.

This wicked miniſter totally concealed from the emperor his having made ſuch a ſhameful treaty with the Moguls; and the 170 ſoldiers maſſacred by his order, gave occaſion to report that the enemy had been defeated; ſo that the Song court believed that they had been compelled to retreat by the ſuperior valour and wiſdom of Kya-tſe-tau. This proved the ruin of the empire; for, in 1260, the Mogul emperor ſent Hanking to the Chineſe court to execute the treaty according to the terms agreed on with Kya-tſe-tau. The miniſter, dreading the arrival of this envoy, impriſoned him near Nanking; and took all poſſible care that neither Hupilay, nor Li-tſong the Chineſe emperor, ſhould ever hear any thing of him.

It was impoſſible ſuch unparalleled conduct could fail to produce a new war. Hupilay's courtiers inceſſantly preſſed him to revenge himſelf on the Song for their treacherous behaviour; and he ſoon publiſhed a manifeſto againſt them, which was followed by a renewal of hoſtilities in 1268. The Mogul army amounted to 300,000 men; but notwithſtanding their numbers, little progreſs was made till the year 1271. Syan-yang and Fan-ching, cities in the province of Se-chew had been beſieged for a long time ineffectually; but this year, an *Igur* lord adviſed Hupilay to ſend for ſeveral of thoſe engineers out of the weſt, who knew how to caſt ſtones of 150 pounds weight out of their engines, which made holes of ſeven or eight feet wide in the ſtrongeſt walls. Two of theſe engineers were accordingly ſent for; and after giving a ſpecimen of their art before Hupilay, were ſent to the army in 1272. In the beginning of 1273 they planted their engines againſt the city of Fan ching, and preſently made a breach in the walls. After a bloody conflict the ſuburbs were taken; and ſoon after the Moguls made themſelves maſters of the walls and gates of the city.

40
Deſperate conflict.

Nevertheleſs, a Chineſe officer, with only 100 ſoldiers, reſolved to fight from ſtreet to ſtreet. This he did for a long time with the greateſt obſtinacy, killing vaſt numbers of the Moguls; and both parties are ſaid to have been ſo much overcome with thirſt, that they drank human blood to quench it. The Chineſe ſet fire to the houſes, that the great beams, falling down, might embarraſs the way of their purſuers; but at laſt being quite wearied out, and filled with deſpair, they put an end to their own lives. After the taking of Fan-ching, all the materials which had ſerved at the ſiege were tranſported to Seyen-yang. The two engineers poſted themſelves againſt a wooden entrenchment raiſed on the ramparts. This they quickly demoliſhed: and the beſieged were ſo intimidated by the noiſe and havock made by the ſtones caſt from theſe terrible engines, that they immediately ſurrendered.

In 1274, Pe-yen, an officer of great valour, and endowed with many other good qualities, was promoted to the command of the Mogul army. His firſt exploits were the taking of two ſtrong cities; after which he paſſed the great river Ky-ang, defeated the Song army, and laid ſiege to Vu-chang-fu. This city was ſoon intimidated into a ſurrender; and Pe-yen, by reſtraining the barbarity of his ſoldiers, whom he would not allow to hurt any body, ſoon gained the hearts of the Chineſe ſo much, that ſeveral cities ſurrendered to him on the firſt ſummons. In the mean time the treacherous Kya-tſe-tau, who was ſent to oppoſe Pe-yen, was not aſhamed to propoſe peace on the terms he had formerly concluded with Hupilay: but theſe being rejected, he was obliged at length to come to an engagement. In this he was defeated, and Pe-yen continued his conqueſts with great rapidity. Having taken the city of Nanking, and ſome others, he marched towards Hang-chew-fu, the capital of the Song empire.

41
Chineſe empreſs ſubmits.

Peace was now again propoſed, but rejected by the Mogul general; and at laſt the empreſs was conſtrained to put herſelf, with her ſon, then an infant, into the hands of Pe-yen, who immediately ſent them to Hupilay.

The ſubmiſſion of the empreſs did not yet put an end to the war. Many of the chief officers ſwore to do their utmoſt to reſcue her from the hands of her enemies. In conſequence of this reſolution they diſtributed their money among the ſoldiers, and ſoon got together an army of 40,000 men. This army attacked the city where the young emperor Kong-tſong was lodged, but without ſucceſs; after which, and ſeveral other vain attempts, they raiſed one of his brothers to the throne, who then took upon him the name of Twon-tſong. He was but nine years of age when he was raiſed to the imperial dignity, and enjoyed it but a very ſhort time. In 1277 he was in great danger of periſhing, by reaſon of the ſhip on board which he then was being caſt away. The poor prince fell into the water, and was taken up half dead with the fright. A great part of his troops periſhed at that time, and he ſoon after made offers of ſubmiſſion to Hupilay. Theſe, however, were not accepted; for, in 1278, the unhappy Twon-tſong was obliged to retire into a little deſert iſland on the coaſt of Quang-tong, where he died in the 11th year of his age.

42
Diſſolution of the Song empire.

Notwithſtanding the progreſs of the Moguls, vaſt territories ſtill remained to be ſubdued before they could become maſters of all the Chineſe empire. On the death of Twon-tſong, therefore, the mandarins raiſed to the throne his brother, named Te-ping, at that time but eight years of age. His army conſiſted of no fewer than 200,000 men; but being utterly void of diſcipline, and entirely ignorant of the art of war, they were defeated by 20,000 Mogul troops. Nor was the fleet more ſucceſsful; for being put in confuſion by that of the Moguls, and the emperor in danger of falling into their hands, one of the officers taking him on his ſhoulders, jumped with him into the ſea, where they were both drowned. Moſt of the mandarins followed this example, as did alſo the empreſs and miniſter, all the ladies and maids of honour, and multitudes of others, inſomuch that 100,000 people are thought to have periſhed on that day. Thus ended the Chineſe race of emperors; and the Mogul dynaſty, known by the name of *Ywen*, commenced.

43
Reign of Hupilay.

Though no race of men that ever exiſted were more remarkable for cruelty and barbarity than the Moguls; yet it doth not appear that the emperors of the Ywen dynaſty were in any reſpect worſe than their predeceſſors. On the contrary, Hupilay, by the Chineſe called *Shi-tſu*, found the way of reconciling the people to his government, and even of endearing himſelf to them ſo much, that the reign of his family is to this day ſtyled by the Chineſe *the wiſe government*. This he accompliſhed by keeping as cloſe as poſſible to their ancient laws and cuſtoms, by his mild and juſt government, and by his regard for their learned men. He was indeed aſhamed of the ignorance and barbarity of his Mogul ſubjects, when compared with the Chineſe. The whole knowledge of the former was ſummed up in their ſkill in managing their arms and horſes, being perfectly deſtitute of every art or ſcience, or even of the knowledge of letters. In 1269, he had cauſed the Mogul characters to be contrived. In 1280, he cauſed ſome mathematicians ſearch for the ſource of the river Whang-ho, which at that time was unknown to the Chineſe themſelves. In four months time they arrived in the country where it riſes, and made a map of it, which they preſented to his majeſty. The ſame year a treatiſe on aſtronomy was publiſhed by his order; and, in 1282, he ordered the learned men to repair from all parts of the empire to examine the ſtate of literature, and take meaſures for its advancement.

42
Moguls driven out.

45
Exploits of Chu.

At his firſt acceſſion to the crown he fixed his reſidence at Tay-ywen-fu, the capital of Shen-ſi; but thought proper afterwards to remove it to Peking. Here, being informed that the barks, which brought to court the tribute of the ſouthern provinces, or carried on the trade of the empire, were obliged to come by ſea, and often ſuffered ſhipwreck, he cauſed that celebrated canal to be made, which is at preſent one of the wonders of the Chineſe empire, being 300 leagues in length. By this canal above 9000 imperial barks tranſport with eaſe, and at ſmall expence, the tribute of grain, rice, ſilks, *&c.* which is annually paid to the court. In the third year of his reign Shi-tſu formed a deſign of reducing the iſlands of Japan, and the kingdoms of Tonkquin and Cochin-china. Both theſe enterpriſes ended unfortunately, but the firſt remarkably ſo; for of 100,000 perſons employed in it, only four or five eſcaped with the melancholy news of the deſtruction of the reſt, who all periſhed by ſhipwreck. Shi-tſu reigned 15 years, died in the 80th year of his age, and was ſucceeded by his grandſon. The throne continued in the Ywen family till the year 1367, when Shun-ti, the laſt of that dynaſty, was driven out by a Chineſe named Chu. During this period the Tartars had become enervated by long proſperity; and the Chineſe had been rouſed into valour by their ſubjection. Shun-ti, the reigning prince, was quite ſunk in ſloth and debauchery; and the empire, beſides, was oppreſſed by a wicked miniſter named Ama. In June 1355, Chu, a Chineſe of mean extraction, and head of a ſmall party, ſet out from How-chew, paſſed the Kyang, and took Tay-ping. He then aſſociated himſelf with ſome other malcontents, at the head of whom he reduced the town of Tu-chew, in Kyang-nan. Soon after he made himſelf maſter of Nanking, having defeated the Moguls who came to its relief. In December 1356, he was able to raiſe 100,000 men, at the head of whom he took the city of U-chew, in the eaſt borders of Quang-ſi; and here, aſſembling his generals, it was reſolved neither to commit ſlaughters nor to plunder. The moſt formidable enemy he had to deal with was *Chen-yew-lyang*, ſtyled "emperor of the Han." This man being grieved at the progreſs made by Chu, equipped a fleet, and raiſed a formidable army, in order to reduce Nan-chang-fu, a city of Kyang-ſi, which his antagoniſt had made himſelf maſter of. The governor, however, found means to inform Chu of his danger; upon which that chief cauſed a fleet to be fitted out at Nanking, in which he embarked 200,000 ſoldiers. As ſoon as Chen-yew-lyang was informed of his enemy's approach, he raiſed the ſiege of Nan-chang-fu, and gave orders for attacking Chu's naval force. An engagement enſued between a part of the fleets, in which Chu proved victorious; and next day, all the ſquadrons having joined in order to come to a general engagement, Chu gained a ſecond victory, and burnt 100 of the enemy's veſſels. A third and fourth engagement happened, in both which Chu gained the victory; and in the laſt, Chen yew-lyang himſelf was killed, his ſon taken priſoner, and his generals obliged to ſurrender themſelves, with all their forces and veſſels.

46 He is proclaimed king of U.

In January 1364, Chu's generals propoſed to have him proclaimed emperor; but this he declined, and at firſt contented himſelf with the title of king of *U.* In February he made himſelf maſter of Vu-chang-fu, capital of Hu-quang; where, with his uſual humanity, he relieved thoſe in diſtreſs, encouraged the literati, and would allow his troops neither to plunder nor deſtroy. This wiſe conduct procured him an eaſy conqueſt both of Kyang-ſi and Hu-quang. The Chineſe ſubmitted to him in crowds, and profeſſed the greateſt veneration and reſpect for his perſon and government.

47 Becomes emperor of China.

48 Moguls driven beyond the deſert.

All this time Shun-ti, with an unaccountable negligence, never thought of exerting himſelf againſt Chu, but continued to employ his forces againſt the rebels who had taken up arms in various parts of the empire; ſo that Chu found himſelf in a condition to aſſume the title of emperor. This he choſe to do at Nanking on the firſt day of the year 1368. After this his troops entered the province of Honan, which they preſently reduced. In the third month, Chu, who had now taken the title of *Hong-vu*, or *Tay-tſu*, reduced the fortreſs of Tong-quan; after which his troops entered Pecheli from Honan on the one ſide, and Shan-tong on the other. Here his generals defeated and killed one of Shun-ti's officers; after which they took the city of Tong-chew, and then prepared to attack the capital, from which they were now but 12 miles diſtant. On their approach the emperor fled with all his family beyond the great wall, and thus put an end to the dynaſty of Ywen. In 1370 he died, and was ſucceeded by his ſon, whom the ſucceſſor of Hong-vu drove beyond the Kobi or Great Deſert, which ſeparates China from Tartary. They continued their incurſions, however, for many years; nor did they ceaſe their attempts till 1583, when vaſt numbers of them were cut in pieces by the Chineſe troops.

49 China again conquered by the Tartars.

The 21ſt dynaſty of Chineſe emperors, founded in 1368 by Chu, continued till the year 1644, when they were again expelled by the Tartars. The laſt Chineſe emperor was named Whay-tſong, and aſcended the throne in 1628. He was a great lover of the ſciences, and a favourer of the Chriſtians; though much addicted to the ſuperſtitions of the Bonzes. He found himſelf engaged in a war with the Tartars, and a number of rebels in different provinces. That he might more effectually ſuppreſs the latter, he reſolved to make peace with the former: and for that end ſent one of his generals, named *Ywen*, into Tartary, at the head of an army, with full power to negociate a peace; but that traitor made one upon ſuch ſhameful terms, that the emperor refuſed to ratify it. Ywen, in order to oblige his maſter to comply with the terms made by himſelf, poiſoned his beſt and moſt faithful general, named *Mau-ven-long;* and then deſired the Tartars to march directly to Peking, by a road different from that which he took with his army. This they accordingly did, and laid ſiege to the capital. Ywen was ordered to come to its relief: but, on his arrival, was put to the torture and ſtrangled; of which the Tartars were no ſooner informed, than they raiſed the ſiege, and returned to their own country. In 1636, the rebels abovementioned compoſed four great armies, commanded by as many generals; which, however, were ſoon reduced to two, commanded by Li and Chang. Theſe agreed to divide the empire between them; Chang taking the weſtern provinces, and Li the eaſtern ones. The latter ſeized on part of Shen-ſi, and then of Honan, whoſe capital, named Kay-fong-fu, he laid ſiege to, but was repulſed with loſs. He renewed it ſix months after, but without ſucceſs; the beſieged chooſing rather to feed on human fleſh than ſurrender. The imperial forces coming ſoon after to its aſſiſtance, the general made no doubt of being able to deſtroy the rebels at once, by breaking down the banks of the Yellow River; but unfortunately the rebels eſcaped to the mountains, while the city was quite overflowed, and 300,000 of the inhabitants periſhed.

50 Unhappy fate of the emperor and his family.

After this diſaſter, Li marched into the provinces of Shen-ſi and Honan; where he put to death all the mandarins, exacted great ſums from the officers in place, and ſhowed no favour to any but the populace, whom he freed from all taxes: by this means he drew ſo many to his intereſt, that he thought himſelf ſtrong enough to aſſume the title of emperor. He next advanced towards the capital, which, though well garriſoned, was divided into factions. Li had taken care to introduce before-hand a number of his men in diſguiſe; and by theſe the gates were opened to him the third day after his arrival. He entered the city in triumph at the head of 300,000 men; whilſt the emperor kept himſelf ſhut up in his palace, buſied only with his ſuperſtitions. It was not long, however, before he found himſelf betrayed: and, under the greateſt conſternation, made an effort to get out of the palace, attended by about 600 of his guards. He was ſtill more ſurpriſed to ſee himſelf treacherouſly abandoned by them, and deprived of all hopes of eſcaping the inſults of his ſubjects. Upon this, preferring death to the diſgrace of falling alive into their hands, he immediately retired with his empreſs, whom he tenderly loved, and the princeſs her daughter, into a private part of the garden. His grief was ſo great that he was not able to utter a word; but ſhe ſoon underſtood his meaning, and, after a few ſilent embraces, hanged herſelf on a tree in a ſilking ſtring. Her huſband ſtaid only to write theſe words on the border of his veſt; "I have been baſely deſerted by my ſubjects; do what you will with me, but ſpare my people." He then cut off the young princeſs's head with one ſtroke of his ſcymitar, and hanged himſelf on another tree, in the 17th year of his reign, and 36th of his age. His prime miniſter, queens, and eunuchs, followed his example; and thus ended the Chineſe monarchy, to give place to that of the Tartars, which hath continued ever ſince.

It was ſome time before the body of the unfortunate monarch was found. At laſt it was brought before the rebel Li, and by him uſed with the utmoſt indignity; after which he cauſed two of Whey-tſong's ſons, and all his miniſters, to be beheaded; but his eldeſt ſon happily eſcaped by flight. The whole empire ſubmitted peaceably to the uſurper, except prince U-ſan-ghey, who commanded the imperial forces in the province of Lyau-tong. This brave prince, finding himſelf unable to cope with the uſurper, invited the

Tartars to his aſſiſtance, and Tſong-te their king immediately joined him with an army of 80,000 men. Upon this the uſurper marched directly to Peking; but not thinking himſelf ſafe there, plundered and burnt the palace, and then fled with the immenſe treaſure he had got. What became of him afterwards we are not told; but the young Tartar monarch was immediately declared emperor of China, his father Tſong-te having died almoſt as ſoon as he ſet his foot in that empire.

The new emperor, named *Shun-chi*, or *Xun-chi*, began his reign with rewarding U-ſan-ghey, by conferring upon him the title of King; and aſſigned him the city of Si-gnan-fu, capital of Shen-ſi, for his reſidence. This, however, did not hinder U-ſan-ghey from repenting of his error in calling in the Tartars, or, as he himſelf uſed to phraſe it, in ſending for lions to drive away dogs." In 1674, he formed a very ſtrong alliance againſt them, and had probably prevailed if his allies had been faithful; but they treacherouſly deſerted him one after another: which ſo affected him, that he died ſoon after. In 1681 Hong-wha, ſon to U-ſan-ghey, who continued his efforts againſt the Tartars, was reduced to ſuch ſtraits that he put an end to his own life.

51
Empire totally reduced.

During this ſpace, there had been ſome reſiſtance made to the Tartars in many of the provinces. Two princes of Chineſe extraction had at different times been proclaimed emperors; but both of them were overcome and put to death. In 1682, the whole 15 provinces were ſo effectually ſubdued, that the emperor Kang-hi, ſucceſſor to Shunc-hi, determined to viſit his native dominions of Tartary. He was accompanied by an army of 70,000 men, and continued for ſome months taking the diverſion of hunting. This he continued to do for ſome years; and in his journeys took father Verbeiſt along with him; by which means we have a better deſcription of theſe countries than could poſſibly have been otherwiſe obtained.

52
Chriſtianity firſt encouraged and then perſecuted

This prince was a great encourager of learning and of the Chriſtian religion; in favour of which laſt he publiſhed a decree, dated in 1692. In 1716, however, he revived ſome obſolete laws againſt the Chriſtians; nor could the Jeſuits with all their art preſerve the footing they had got in China. The cauſes of this alteration in his reſolution are, by the miſſionaries, ſaid to have been the ſlanders of the mandarins: but, from the known character of the Jeſuits, it will be readily believed, that there was ſomething more at bottom. This emperor died in 1722, and was ſucceeded by his ſon Yon-ching; who not only gave no encouragement to the miſſionaries, but perſecuted all Chriſtians of whatever denomination, not excepting even thoſe of the imperial race. At the beginning of his reign he baniſhed all the Jeſuits into the city of Canton, and in 1732 they were baniſhed from thence into Ma-kau, a little iſland inhabited by the Portugueſe, but ſubject to China. He died in 1736; but though the Jeſuits entertained great hopes from his ſucceſſor, we have not heard that they have yet met with any ſucceſs.

Thus we have given an account of the moſt memorable tranſactions recorded in the Chineſe hiſtory. It now remains only to deſcribe the preſent ſtate of the empire and its inhabitants, according to the beſt and lateſt accounts.

53
Climate, ſoil, and produce.

The climate as well as the ſoil of this extenſive empire is very different in different parts; ſevere cold being often felt in the northern provinces, while the inhabitants of the ſouthern ones are ſcarce able to bear the heat. In general, however, the air is accounted wholeſome, and the inhabitants live to a great age.—The northern and weſtern provinces have many mountains, which in the latter are cultivated, but in the north are barren, rocky, and incapable of improvement. On the mountains of Chenſi, Honan, Canton, and Fokien, are many foreſts, abounding with tall, ſtraight trees, of different kinds, fit for building, and particularly adapted for maſts and ſhip-timber. Theſe are uſed by the emperor in his private buildings; and from theſe foreſts enormous trunks are ſometimes tranſported to the diſtance of more than 300 leagues. Other mountains contain quickſilver, iron, tin, copper, gold, and ſilver. Formerly theſe laſt were not allowed to be opened, leſt the people ſhould thereby be induced to neglect the natural riches of the ſoil; and it is certain, that, in the 15th century, the emperor cauſed a mine of precious ſtones to be ſhut, which had been opened by a private perſon. Of late, however, the Chineſe are leſs ſcrupulous, and a great trade in gold is carried on by them. Many extravagant fables are told by the Chineſe of their mountains, particularly of one in Chen-ſi which throws out flames, and produces violent tempeſts, whenever any one beats a drum or plays on a muſical inſtrument near it. In the province of Folkien is a mountain, the whole of which is an idol, or ſtatue of the god Fo. This natural coloſſus, for it appears not to have been the work of art, is of ſuch an enormous ſize, that each of its eyes is ſeveral miles in circumference, and its noſe extends ſome leagues.

54
Lakes and rivers.

China has ſeveral large lakes; the principal one is that named Poyang-hou, in the province of Kiang-ſi. It is formed by the confluence of four large rivers, extends near 100 leagues in length; and, like the ſea, its waters are raiſed into tempeſtuous waves. The empire is watered by an immenſe number of rivers of different ſizes, of which two are particularly celebrated, *viz*. the *Yang-tſe-kiang*, or *ſon of the ſea*, and *Hoang-ho*, or the *Yellow river*. The former riſes in the province of Yun-nan, and paſſing through Hou-quang and Kiang-nan, falls into the eaſtern ocean, after a courſe of 1200 miles, oppoſite to the iſland of Tſon-ming, which is formed by the ſand accumulated at its mouth. This river is of immenſe ſize, being half a league broad at Nanking, which is near 100 miles from its mouth. The navigation is dangerous, ſo that great numbers of veſſels are loſt on it. It runs with a rapid current, forming ſeveral iſlands in its courſe, which are again carried off and new ones formed in different places, when the river is ſwelled by the torrents from the mountains. Theſe iſlands, while they remain, are very uſeful; producing great quantities of reeds ten or twelve feet high, which are uſed in all the neighbouring countries for fuel. The Hoang-ho, or yellow river, has its name from the yellow colour given it by the clay and ſand waſhed down in the time of of rain. It riſes in the mountains which border the province of Te-tchuen on the weſt, and after a courſe of near 600 leagues, diſcharges itſelf into the eaſtern ſea not far from the mouth of the Kiang. It is very broad and rapid, but ſo ſhallow that it is ſcarce navigable,

gable. It is very liable to inundations, often overflowing its banks, and deſtroying whole villages. For this reaſon it has been found neceſſary to confine it in ſeveral places by long and ſtrong dykes; which yet do not entirely anſwer the purpoſe. The people of Honan, therefore, whoſe land is exceedingly low, have ſurrounded moſt of their cities with ſtrong ramparts of earth faced with turf, at the diſtance of three furlongs.

55 Canals. The Chineſe have been at great pains to turn their lakes and rivers to the advantage of commerce, by promoting an inland navigation. One of their principal works for this purpoſe, is the celebrated canal reaching from Canton to Peking, and forming a communication between the ſouthern and northern provinces. This canal extends through no leſs a ſpace than 600 leagues; but its navigation is interrupted in one place by a mountain, where paſſengers are obliged to travel 10 or 12 leagues over land. A number of other canals are met with in this and other provinces; moſt of which have been executed by the induſtry of the inhabitants of different cities and towns, in order to promote their communication with the various parts of the empire. M. Groſier remarks, that, in theſe works, the Chineſe have "ſurmounted obſtacles that perhaps would have diſcouraged any other people; ſuch, for example, is a part of a canal which conducts from *Chao-king* to *Ning-po*." Near theſe cities there are two canals, the waters of which do not communicate, and which differ ten or twelve feet in their level. To render this place paſſable for boats, the Chineſe have conſtructed a double glacis of large ſtones, or rather two inclined planes, which unite in an acute angle at their upper extremity, and extend on each ſide to the ſurface of the water. If the bark is in the lower canal, they puſh it up the plane of the firſt glacis by means of ſeveral capſtans, until it is raiſed to the angle, when by its own weight it glides down the ſecond glacis, and precipitates itſelf into the water of the higher canal with the velocity of an arrow. It is aſtoniſhing that theſe barks, which are generally very long and heavily loaden, never burſt aſunder when they are balanced on this acute angle; however, we never hear of any accident of this kind happening in the paſſage. It is true, they take the precaution of uſing for their keels a kind of wood which is exceedingly hard, and proper for reſiſting the violence of ſuch an effort.

56 Remarkable river, which partly ſinks under ground. The following remarkable phenomenon in a Chineſe river is related by Father *le Couteux*, a French miſſionary. "Some leagues above the village Che-pai (ſays he), the river becomes conſiderably ſmaller, although none of its waters flow into any other channel; and, eight or nine leagues below, it reſumes its former breadth, without receiving any additional ſupply, excepting what it gets from a few ſmall rivulets, which are almoſt dry during the greater part of the year. Oppoſite to Che-pai it is ſo much diminiſhed, that, excepting one channel, which is not very broad, I have paſſed and repaſſed it ſeveral times by the help of a common pole. I was always ſurpriſed to find this river ſo narrow and ſhallow in that place; but I never thought of inquiring into the cauſe of it, until the loſs of a bark belonging to a Chriſtian family afforded me an opportunity. In that place where the river diminiſhes almoſt of a ſudden, it flows with great impetuoſity; and where it reſumes its former breadth it is equally rapid. At the ſixth moon, when the water was high and the wind ſtrong, the bark I have mentioned arriving above Che-pai, was driven on a ſand-bank; for between theſe two places the river is full of moveable ſands, which are continually ſhifting their ſituation. The maſter of the boat dropped his anchor until the wind ſhould abate, and permit him to continue his voyage; but a violent vortex of moveable ſand, which was caſt up from the bottom of the river, laid the bark on its ſide; a ſecond vortex ſucceeded; then a third; and afterwards a fourth, which ſhattered the bark to pieces. When I arrived at the place where this bark had been loſt, the weather was mild and ſerene; I perceived eddies in the current every where around; which abſorbed, and carried to the bottom of the river whatever floated on the ſurface; and I obſerved, at the ſame time, that the ſand was thrown violently up with a vortical motion. Above theſe eddies the water was rapid, but without any fall; and in the place below, where the river reſumes its uſual courſe, no eddies are to be ſeen, but the ſand is thrown up in the ſame violent manner; and in ſome places there are water-falls, and a kind of ſmall iſlands ſcattered at ſome diſtance from one another. Theſe iſlands which appear above the ſurface of the water, are not ſolid earth, but conſiſt of branches of trees, roots, and herbs collected together. I was told that theſe boughs roſe up from the water, and that no one knew the place from whence they came. I was informed, that theſe maſſes, which were 40 or 50 feet in extent on that ſide on which we paſſed, were immoveable, and fixed in the bottom of the river; that it was dangerous to approach them, becauſe the water formed whirlpools every where around them; that, however, when the river was very low, the fiſhermen ſometimes ventured to collect the buſhes that floated on its ſurface, and which they uſed for fuel. I am of opinion, that, at the place of the river which is above Che-pai, the water falls into deep pits, from whence it forces up the ſand with that vortical motion; and that it flows underground to the other place, eight or nine leagues below, where it carries with it all the boughs, weeds, and roots, which it waſhes down in its courſe, and thus forms thoſe iſlands which appear above its ſurface. We know there are ſome rivers that loſe themſelves entirely, or in part, in the bowels of the earth, and which afterwards ariſe in ſome other place; but I believe there never was one known to loſe part of its water below its own channel, and again to recover it at the diſtance of ſome leagues."

57 Why China is ſubject to famines, notwithſtanding its fertility. It has already been ſaid, that China is, in general, a a fertile country; and indeed all travellers agree in this reſpect, and make encomiums on the extent and beauty of its plains. So careful are the huſbandmen of this empire to loſe none of their ground, that neither incloſure, hedge, nor ditch, nay, ſcarce a ſingle tree, are ever to be met with. In ſeveral places the land yields two crops a year; and even in the interval between the harveſts, the people ſow ſeveral kinds of pulſe and ſmall grain. The plains of the northern provinces yield wheat; thoſe of the ſouthern, rice, becauſe the country is low and covered with water. Notwithſtanding all this fertility, however, the inhabitants are much more frequently afflicted with famine than thoſe of the European nations, though the countries of Europe produce much leſs than China. For

this two cauſes are aſſigned. 1. The deſtruction of the riſing corps by drought, hail, inundations, locuſts, *&c.* in which caſe China cannot like the European countries be ſupplied by importation. This is evident by conſidering how it is ſituated with regard to other nations. On the north are the Mogul Tartars, a lazy and indolent race, who ſubſiſt principally on the fleſh of their flocks; ſowing only a little millet for their own uſe. The province of Leatong, which lies to the north-eaſt, is indeed extremely fertile, but too far diſtant from the capital and centre of the empire to ſupply it with proviſions; and beſides, all carriage is impracticable but in the winter, when great quantities of game, and fiſh, preſerved in ice, are ſent thither. No corn is brought from Corea to China; and, though the Japan iſlands are only three or four days ſailing from the Chineſe provinces of Kiang-nan and Che-kyang, yet no attempt was ever made to obtain proviſions from thence, whether it be, that the Japaneſe have nothing to ſpare, or on account of the inſults offered by theſe iſlanders to foreign merchants. Formoſa lies oppoſite to the province of Fo-kien; but ſo far is that iſland from being able to ſupply any thing, that in a time of ſcarcity it requires a ſupply from China itſelf. The province of Canton is alſo bounded by the ſea, and has nothing on the ſouth but iſlands and remote countries. One year, when rice was exceedingly ſcarce there, the emperor ſent for F. Parranin, a Jeſuit miſſionary, and aſked him if the city of Macao could not furniſh Canton with rice until the ſupply he had ordered from other provinces ſhould arrive; but was informed that Macao had neither rice, corn, fruits, herbs, nor flocks; and that it generally got from China what was neceſſary for its ſubſiſtence.—The only method, therefore, the Chineſe can take to guard againſt famines ariſing from theſe cauſes is to erect granaries and public magazines in every province and moſt of the principal cities of the empire. This has at all times been a principal object of care to the public miniſters; but though this mode of relief ſtill takes place in theory, ſo many ceremonies are to be gone through before any ſupply can be drawn from thoſe public repoſitories, that it ſeldom arrives ſeaſonably at the places where it is wanted; and thus numbers of unhappy wretches periſh for want. 2. Another cauſe of the ſcarcity of grain in this empire, is the prodigious conſumpt of it in the compoſition of wines, and a ſpirituous liquor called *rack*. But though government is well appriſed that this is one of the principal ſources of famine throughout the empire, it never employed means ſufficient to prevent it. Proclamations indeed have frequently been iſſued, prohibiting the diſtillation of rack; and the appointed officers will viſit the ſtill-houſes and deſtroy the furnaces if nothing is given them; but on ſlipping ſome money into their hands, they ſhut their eyes, and go ſomewhere elſe to receive another bribe. When the mandarin himſelf goes about, however, theſe diſtillers do not eſcape quite ſo eaſily, the workmen being whipped and impriſoned, after which they are obliged to carry a kind of collar called the *Cangue*[*]; the maſters are likewiſe obliged to change their habitations and conceal themſelves for a ſhort time, after which they generally reſume their operations. It is impoſſible, however, that any method of this kind can prove effectual in ſuppreſſing theſe manufactories while the liquors themſelves are allowed to be ſold publicly; and againſt this there is no law throughout the empire. Our author, however, juſtly obſerves, that in caſe of a prohibition of this kind, the grandees would be obliged to deny themſelves the uſe of theſe luxuries, which would be too great a ſacrifice for the good of the empire.

58 Immenſe population.

The population of China is ſo great, in compariſon with that of the European countries, that the accounts of it have generally been treated as fabulous by the weſtern nations; but by an accurate inveſtigation of ſome Chineſe records concerning the number of perſons liable to taxation throughout the empire, M. Groſier has ſhowed that it cannot be leſs than 200 millions. For this extraordinary population he aſſigns the following cauſes. 1. The ſtrict obſevance of filial duty throughout the empire, and the prerogatives of fraternity, which make a ſon the moſt valuable property of a father. 2. The infamy attached to the memory of thoſe who die without children. 3. The univerſal cuſtom by which the marriage of children becomes the principal concern of the parents. 4. The honours beſtowed by the ſtate on thoſe widows who do not marry a ſecond time. 5. Frequent adoptions, which prevent families from becoming extinct. 6. The return of wealth to its original ſtock by the diſinheriting of daughters. 7. The retirement of wives, which renders them more complaiſant to their huſbands, ſaves them from a number of accidents when big with child, and conſtrains them to employ themſelves in the care of their children. 8. The marriage of ſoldiers. 9. The fixed ſtate of taxes; which being always laid upon lands, never fall but indirectly on the trader and mechanic. 10. The ſmall number of ſailors and travellers. 11. To theſe may be added the great number of people who reſide in China only by intervals; the profound peace which the empire enjoys; the frugal and laborious manner in which the great live; the little attention that is paid to the vain and ridiculous prejudice of marrying below one's rank; the ancient policy of giving diſtinction to men and not to families; by attaching nobility only to employments and talents, without ſuffering it to become hereditary. And, 12. laſtly, A decency of public manners, and a total ignorance of ſcandalous intrigues and gallantry.

59 Unlimited authority of the emperor.

The government of China, according to the Abbe Groſier, is purely patriarchal. The emperor is more unlimited in his authority than any other potentate on earth; no ſentence of death, pronounced by any of the tribunals can be executed without his conſent, and every verdict in civil affairs is ſubject to be reviſed by him; nor can any determination be of force until it has been confirmed by the emperor: and, on the contrary, whatever ſentence he paſſes is executed without delay; his edicts are reſpected throughout the empire as if they came from a divinity; he alone has the diſpoſal of all offices, nor is there any ſuch thing as the purchaſe of places in China; merit, real or ſuppoſed, raiſes to an office, and rank is attached to it only. Even the ſucceſſion to the throne is not altogether hereditary. The emperor of China has a power of chooſing his own ſucceſſor without conſulting any of his nobility; and can ſelect one not only from among his own children, but even from the body of his people; and there have been ſeveral inſtances of his making uſe of this right: and he has even a power of altering the ſucceſſion after it has once been fixed, in caſe the perſon pitched upon does not behave towards him with proper reſpect. The emperor can alſo prevent the princes of the blood from exerciſing the title, with which, according to the conſtitution of the empire, they are inveſted. They may indeed, notwithſtanding this poſſeſs their hereditary dignity; in which caſe they are allowed a revenue proportioned to their high birth, as well as a palace, officers, and a court; but they have neither influence nor power, and their authority is lower than that of the meaneſt mandarin.

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[*] See below No. 74.

60
Mandarins of different claſſes.

The mandarins are of two claſſes, *viz.* thoſe of letters, and the inferior ſort, ſtyled mandarins of arms. The latter by no means enjoy the ſame conſideration with the former ſort; indeed in China the literati are highly honoured, and to their influence M. Groſier ſuppoſes that we may in a great meaſure aſcribe the mildneſs and equity of the government; though he thinks that the balance may incline rather too much in their favour. Several degrees, anſwering to thoſe of bachelor, licentiate, and doctor, muſt be paſſed through before one can attain to the dignity of a mandarin of letters; though ſometimes, by the favour of the emperor, it is conferred on thoſe who have attained only the two firſt degrees: but even the perſons who have gone through all the three, enjoy at firſt only the government of a city of the ſecond or third claſs. When ſeveral vacancies happen in the government of cities, the emperor invites to court a correſponding number of the literati, whoſe names are written down in a liſt. The names of the vacant governments are then put into a box, raiſed ſo high that the candidates are able only to reach it with their hands; after which they draw in their turns, and each is appointed governor of the city whoſe name he has drawn.

There are eight orders of theſe mandarins in China. 1. The *calao*, from whom are choſen the miniſters of ſtate, the preſidents of the ſupreme courts, and all the ſuperior officers among the militia. The chief of this order preſides alſo in the emperor's council, and enjoys a great ſhare of his confidence. 2. The *te-hioſe*, or man of acknowledged ability, is a title beſtowed upon every mandarin of the ſecond rank; and from theſe are ſelected the viceroys and preſidents of the ſupreme council in the different provinces. 3. The *tchong-tchuco*, or ſchool of mandarins, act as ſecretaries to the emperor. 4. *Y-tchuen,-tao.* Theſe keep in repair the harbours, royal lodging-houſes, and barks, which belong to the emperor, unleſs particularly engaged in ſome other office by his order. 5. The *ping-pi-tao* have the inſpection of the troops. 6. The *tun-tien-hao* have the care of the high-ways. 7. The *ho-tao* ſuperintend the rivers. 8. The *hai-tao* inſpect the ſea-coaſts.

Thus the whole adminiſtration of the Chineſe empire is intruſted to the mandarins of letters; and the homage paid by the common people to every mandarin in office, almoſt equals that paid to the emperor himſelf. This indeed flows from the nature of their government. In China it is a received opinion that the emperor is the father of the whole empire; that the governor of a province is the father of that province; and that the Mandarin who is governor of a city is alſo the father of that city. This idea is productive of the higheſt reſpect and ſubmiſſion, which is not at all leſſened by their great number; for though the mandarins of letters amount to more than 14,000, the ſame reſpect is paid to every one of them.

The mandarins of arms are never indulged with any ſhare in the government of the ſtate; however, to attain to this dignity, it is alſo neceſſary to paſs through the degrees of bachelor, licentiate, and doctor of arms. The accompliſhments neceſſary for a mandarin of arms are, ſtrength of body, with ability and readineſs in performing the various military exerciſes, and comprehending the orders requiſite for the profeſſion of arms: an examination on theſe ſubjects muſt be undergone before the candidate can obtain the wiſhed for dignity.

61
Tribunal of the mandarins of arms.

The mandarins of arms have tribunals, the members of which are ſelected from among their chiefs; and among theſe they reckon princes, counts, and dukes; for all theſe dignities, or ſomething equivalent to them, are met with in China. The principal of theſe tribunals is held at Peking, and conſiſts of five claſſes. 1. The mandarins of the rear-guard, called *heou-feu.* 2. Of the left wing, or *tſa-ſou.* 3. Of the right wing, or *yeou-ſeou.* 4. Of the advanced main-guard, or *te-hong-ſou.* 5. Of the advanced guard, or *tſien-ſou.* Theſe five tribunals are ſubordinate to one named *iong-tching-ſou;* the preſident of which is one of the great lords of the empire, whoſe authority extends over all the military men in the empire. By his high dignity he could render himſelf formidable even to the emperor; but to prevent this inconvenience, he has for his aſſeſſor a mandarin of letters, who enjoys the title and exerciſes the function of ſuperintendant of arms. He muſt alſo take the advice of two inſpectors who are named by the emperor; and when theſe four have agreed upon any meaſure, their reſolution muſt ſtill be ſubmitted to the reviſal of an higher court named *Ping-pou*, which is entirely of a civil nature. The chief of theſe mandarins is a general of courſe, whoſe powers are equivalent to thoſe of our commanders in chief; and below him are other mandarins who act as ſubordinate officers.

Theſe two claſſes of mandarins compoſe what is called the nobility of China; but as we have already hinted, their office is not hereditary; the emperor alone continues or confers it. They have the privilege of remonſtrating to the emperor, either as individuals or in a body, upon any part of his conduct which appears contrary to the intereſts of the empire. Theſe remonſtrances are ſeldom ill received, though the ſovereign complies with them only when he himſelf thinks proper. The number of literary mandarins in China is computed at upwards of 14,000; and thoſe of arms at 18,000; the former, however, are conſidered as the principal body in the empire; and this preference is thought to damp the military ardour of the nation in general, and to be one cauſe of that weakneſs in war for which the Chineſe are remarkable.

62
Military force.

The armies of this empire are proportioned to its vaſt extent and population; being computed in time of peace at more than 700,000. Their pay amounts to about twopence half-penny and a meaſure of rice per day, though ſome of them have double pay, and the pay of a horſeman is double that of a foot-ſoldier; the emperor furniſhes a horſe, and the horſeman receives two meaſures of ſmall beans for his daily ſubſiſtence; the arrears of the army being punctually paid up every three months.

The arms of a horſeman are, a helmet, cuiraſs, lance, and ſabre; thoſe of a foot-ſoldier are a pike and ſabre; ſome have fuſees, and others bows and arrows. All theſe are carefully inſpected at every review; and if any of them are found in the leaſt ruſted, or otherwiſe in bad condition, the poſſeſſor is inſtantly puniſhed; if a Chineſe, with 30 or 40 blows of a ſtick; or, if a Tartar, with as many laſhes.

63
Uſe of fire-arms loſt and revived.

Though the uſe of gun-powder is certainly very ancient in China, it appears to have been afterwards totally loſt, at leaſt fire-arms ſeem to have been almoſt entirely unknown ſome centuries ago. Three or four cannon were to be ſeen at that time about the gates of Nanking; but not a ſingle perſon in China knew how to make uſe of them; ſo that, in 1621, when the city of Macao made a preſent of three pieces of artillery to the emperor, it was found neceſſary alſo to ſend three men to load them. The utility of theſe weapons was quickly perceived by the execution which the three cannon did againſt the Tartars, at that time advanced as far as the great wall. When the invaders threatened to return, the mandarins of arms gave it as their opinion, that cannons were the beſt arms they could make uſe of againſt them. They were then taught the art of caſting cannon by F. Adam Schaal and Verbieſt, two Jeſuit miſſionaries, and their artillery was increaſed to the number of 320 pieces; at the ſame time that they were inſtructed in the method of fortifying towns, and conſtructing fortreſſes and other buildings according to the rules of modern architecture.

The beſt ſoldiers in China are procured from the three northern provinces, the others being ſeldom called forth, but allowed to remain at peace with their families: indeed there is not often occaſion for exerting their military talents, unleſs it be in the quelling of an inſurrection, when a mandarin or governor uſually accompanies them. They march in a very tumultuous manner, but want neither ſkill nor agility in performing their different evolutions. They, in general, handle a ſabre well, and ſhoot very dexterouſly with bows and arrows. There are in China more than 2000 places of arms; and through the different provinces there are diſperſed about 3000 towers or caſtles, all of them defended by garriſons. Soldiers continually mount guard there; and on the firſt appearance of tumult, the neareſt centinel makes a ſignal from the top of the tower, by hoiſting a flag in the day time, or lighting a torch in the night; when the neighbouring garriſons immediately repair to the place where their preſence is neceſſary.

64
Account of the great wall.

The principal defence of the empire againſt a foreign enemy is the great wall which ſeparates China from Tartary, extending more than 1500 miles in length, and of ſuch thickneſs that ſix horſeman may eaſily ride abreaſt upon it. It is flanked with towers two bow-ſhots diſtant from one another; and it is ſaid that a third of the able bodied men in the empire were employed in conſtructing it. The workmen were ordered, under pain of death, to place the materials ſo cloſely, that not the leaſt, entrance might be afforded for any inſtrument of iron; and thus the work was conſtructed with ſuch ſolidity, that it is ſtill almoſt entire, though 2000 years have elapſed ſince it was conſtructed. This extraordinary work is carried on not only through the low lands and valleys, but over hills and mountains; the height of one of which was computed by F. Verbieſt at 1236 feet above the level of the ſpot where he ſtood. According to F. Martini it begins at the gulf of Lea tong, and reaches to the mountains near the city of Kin on the yellow river; between which places it meets with no interruption except to the north of the city of Suen in the province of Pecheli, where it is interrupted by a ridge of hedious and inacceſſible mountains, to which it is cloſely united. It is likewiſe interrupted by the river Hoang-ho; but for others of an inferior ſize, arches have been conſtructed, through which the water paſſes freely. Mr Bell informs us, that it is carried acroſs rivers, and over the tops of the higheſt hills, without the leaſt interruption, keeping nearly along that circular range of barren rocks which incloſes the country; and, after running about 1200 miles, ends in impaſſable mountains and ſandy deſerts. The foundation conſiſts of large blocks of ſtone laid in mortar; but all the reſt is of brick. The whole is ſo ſtrong and well built, that it ſcarcely needs any repairs; and, in the dry climate in which it ſtands, may remain in the ſame condition for many ages. When carried over ſteep rocks, where no horſe can paſs, it is about 15 or 20 feet high: but when running through a valley, or croſſing a river, it is about 30 feet high, with ſquare towers and embraſures at equal diſtances. The top is flat, and paved with cut ſtone; and where it riſes over a rock or eminence, there is an aſcent made by an eaſy ſtone-ſtair. "This wall (our author adds) was begun and completely finiſhed in the ſhort ſpace of five years; and it is reported, that the labourers ſtood ſo cloſe for many miles, that they could hand the materials from one to another. This ſeems the more probable, as the rugged rocks among which it is built muſt have prevented all uſe of carriages; and neither clay for making bricks, nor any kind of cement, are to be found among them."

65
Courts by which the civil government is managed.

The whole civil government of China is managed by the following courts. 1. The emperor's grand council, compoſed of all the miniſters of ſtate, preſidents and aſſeſſors of the ſix ſovereign courts, and of three others, to be afterwards mentioned. This is never aſſembled but on affairs of the greateſt importance; the emperor's private council being ſubſtituted to it in all caſes of ſmaller moment. 2. The chief of the other courts furniſhes mandarins for the different provinces, watches over their conduct, and keeps a journal of their tranſactions, and informs the emperor of them, who rewards or puniſhes according to the report he gets.

This ſecond tribunal, which may be called a kind of civil inquiſition, is ſubdivided into four others; the firſt entruſted with the care of ſelecting thoſe who, on account of their learning or other good properties, are capable of filling the offices of government; the ſecond appointed to take care of the conduct of the mandarins; the third affixing the ſeals to the different public acts, giving the ſeals to mandarins, and examining thoſe of the different diſpatches; while the fourth enquires into the merit of the grandees of the empire, not excepting the princes of the imperial blood themſelves. The principal ſovereign court to which theſe four laſt are ſubordinate is called *Li-pou*.

2. *Hou-pou*, or the grand treaſurer, ſuperintends all the finances of the ſtate; is the guardian and protector of the treaſures and dominions of the emperor, keeping an account of his revenues, *&c.* ſuperintending the management and coining of money; the public magazines, cuſtom-houſes; and, laſtly, keeping an exact regiſter of all the families in the empire. To aſſiſt this court, 14 others are appointed throughout the different provinces of the empire.

3. *Li-pou*, or the court of ceremonies. "It is an undoubted fact (ſays M. Groſier), that ceremonies form, in part, the baſe of the Chineſe government. This tribunal therefore takes care to ſupport them, and enforce their obſervance; it inſpects alſo the arts and ſciences. It is conſulted by the emperor when he deſigns to confer particular honours; takes care of the annual ſacrifices offered up by him, and even regulates the entertainments which he gives either to ſtrangers or his own ſubjects. It alſo receives and entertains foreign ambaſſadors, and preſerves tranquillity among the different religious ſects in the empire. It is aſſiſted by four inferior tribunals.

4. *Ping-pou*, or the tribunal of arms, comprehends in its juriſdiction the whole militia of the empire; inſpecting alſo the fortreſſes, magazines, arſenals, and ſtore-houſes of every kind, as well as the manufactories of arms both offenſive and defenſive; examining and appointing officers of every rank. It is compoſed entirely of mandarins of letters; and the four tribunals depending upon it conſiſt alſo of literati."

5. The *hong-pou* is the criminal bench for the whole empire, and is aſſiſted by 14 ſubordinate tribunals.

6. The *cong-pou*, or tribunal of public works, ſurveys and keeps in repair the emperor's palaces, as well as thoſe of the princes and viceroys, and the buildings where the tribunals are held, with the temples, tombs of the ſovereigns, and all public monuments. It has beſides the ſuperintendence of the ſtreets, public highways, bridges, lakes, rivers, and every thing relating either to internal or foreign navigation. Four inferior tribunals aſſiſt in the diſcharge of theſe duties; the firſt drawing the plans of public works: the ſecond directing the work-ſhops in the different cities of the empire; the third ſurveying the cauſeways, roads, bridges, canals, &c.; and the fourth taking care of the emperor's palaces, gardens, and orchards, and receiving their produce.

66 Partiality of government towards the Chineſe.

All thoſe tribunals are compoſed, one half of Chineſe, and the other of Tartars; and one of the preſidents of each ſuperior tribunal is always a Tartar born. None of the courts above deſcribed, however, has abſolute authority even in its own juriſdiction; nor can its deciſions be carried into execution without the concurrence of another tribunal, and ſometimes of ſeveral others. The fourth tribunal, for inſtance, has indeed under its juriſdiction the whole troops of the empire; but the payment of them is entruſted with the ſecond, while the ſixth has the care of the arms, tents, chariots, barks, and ſtores neceſſary for military operations; ſo that nothing relative to theſe can be put in execution without the concurrence of all the three tribunals.

67 Cenſors.

To prevent any lawful combination among the tribunals, each has its *cenſor* appointed. This is an officer whoſe duty is merely to watch over the proceedings of the court, without deciding upon any thing himſelf. He aſſiſts therefore at all aſſemblies, reviſes all their acts, and without acquainting the court in the leaſt with either his ſentiments or intentions, immediately informs the emperor of what he judges to be amiſs. He likewiſe gives information of the behaviour of the mandarins, either in the public adminiſtration of affairs, or in their private conduct; nay, ſometimes he will not ſcruple to reprimand the emperor for what he ſuppoſes to be erroneous in his conduct.

Theſe cenſors are never removed from their places but in order to be promoted; and thus, holding their offices for life, they have the greater courage to ſpeak out when they obſerve any impropriety or abuſe. Their accuſation is ſufficient to ſet on foot an inquiry, which generally leads to a proof; in which caſe the accuſed is diſcharged from his office, and never held in any eſtimation afterwards. The complaints of the cenſors, however, are referred to the very tribunals againſt whoſe members they complain; though, being afraid of an accuſation themſelves, they very ſeldom paſs ſentence againſt the accuſers.

Beſides all this, the cenſors alſo form a tribunal of their own, named *tou-tche-yven*. Its members have a right of remonſtrating with the emperor, whenever his own intereſt or that of the public renders it neceſſary. They inſpect all lawyers and military men in public employments. "In ſhort (ſays M. Groſier), they are, morally ſpeaking, placed between the prince and the mandarins; between the mandarines and the people; between the people and families; between families and individuals; and they generally unite to the importance of their office incorruptible probity and invincible courage. The ſovereign may, if he proceeds to rigour, take away their lives; but many of them have patiently ſuffered death, rather than betray the cauſe of truth, or wink at abuſes. It is not ſufficient therefore to have got rid of one, they muſt all be treated in the ſame manner; the laſt that might be ſpared would tread in the ſame ſteps with no leſs reſolution than thoſe who went before him. In the annals of no nation do we find an example of ſuch a tribunal, yet it appears to be neceſſary in all, without exception. We muſt not, however, imagine, that the privileges of a cenſor gave him a right to forget his duty to his ſovereign, or to communicate to the public thoſe remarks which he takes the liberty of making to him: were he only to give the leaſt hint of them to his colleagues, he would be puniſhed with death; and he would ſhare the ſame fate did he, in any of his repreſentations, ſuffer a ſingle word, inconſiſtent with moderation or reſpect, to eſcape him."

68 Two courts peculiar to China.

There are ſtill two other courts in China, both of them peculiar to the empire, which deſerve to be mentioned. The firſt is that of princes; and which, in conformity with its title, is compoſed of princes only.

In the regiſters of this tribunal are inſcribed the names of all the children of the imperial family as ſoon as they are born; and to theſe are alſo conſigned the dignities and titles which the emperor confers upon them. This is the only tribunal where the princes can be tried; and here they are abſolved or puniſhed according to the pleaſure of the judges.

The other tribunal is that of hiſtory, called by the Chineſe *han-lin-yuan*. It is compoſed of the greateſt geniuſes of the empire, and of men of the moſt profound erudition. Theſe are entruſted with the education of the heir apparent to the throne, and the compilation and arrangement of the general hiſtory of the empire; which laſt part of their office renders them formidable even to the emperor himſelf. From this body the mandarins of the firſt claſs, and the preſidents of the ſupreme claſs, are generally choſen.

69 Filial piety the baſis of all their laws:

The baſis of all the civil laws of the Chineſe is filial piety. Every mandarin, who is a governor either of a province or city, muſt inſtruct the people aſſembled round him twice a month, and recommend to them the obſervance of certain ſalutary rules, which are ſummed up in a few ſhort ſentences, and ſuch as no perſon can ever be ſuppoſed capable of forgetting.

70 Of their marriages.

The Chineſe are allowed only to have one wife, whoſe rank and age muſt be nearly equal to that of their huſbands; but they are allowed to have ſeveral concubines, whom they may admit into their houſes without any formality, after paying the parents a ſum of money, and entering into a written engagement to uſe their daughters well. Theſe concubines, however, are all in ſubjection to the lawful wife; their children are conſidered as heirs; they addreſs her as mother, and can give this title to her only. A perſon that has once been married, whether man or woman, may lawfully marry again, but it is then no longer neceſſary to ſtudy equality of age or condition. A man may chooſe his ſecond wife from among his concubines; and, in all caſes, this new marriage requires very few formalities. A widow is abſolute miſtreſs of herſelf, and can neither be compelled by her parents to marry again, nor to continue in a ſtate of widowhood, contrary to her own inclination. Thoſe of moderate rank, however, who have no children, do not enjoy the ſame privilege, as the parents of the former huſband can diſpoſe of her in marriage, not only without her conſent, but without her knowledge. The law authoriſes the diſpoſal of them in this manner, in order to indemnify the relations of the deceaſed huſband for the money they may have coſt him. If the wife is left big with child, this cannot take place, until ſhe is delivered; nor can it be done at all if ſhe brings forth a ſon. There are likewiſe two exceptions; 1. when the parents of the widow aſſign her a proper maintenance; and, 2. if the widow embraces a religious life, and becomes a bonzeſſe.

71 Divorces, unlawful marriages, &c.

Divorces are allowed in China in caſes of adultery, mutual diſlike, incompatibility of tempers, jealouſy, &c. No huſband, however, can put away or ſell his wife until a divorce is legally obtained; and if this regulation be not ſtrictly obſerved, the buyer and ſeller become equally culpable. If a wife, lawfully married, privately withdraws herſelf from her huſband, he may immediately commence an action at law; by the ſentence of which ſhe becomes his ſlave, and he is at liberty to ſell her to whom he pleaſes. On the other hand, if an huſband leaves his wife for three years, ſhe is at liberty, after laying her caſe before the mandarins, to take another huſband; but if ſhe were to anticipate their conſent, ſhe would be liable to a ſevere puniſhment.

Marriage is deemed illegal in China in the following caſes. 1. If a young woman has been betrothed to a young man, and preſents have been given and received by the parents of the intended huſband and wife. 2. If in the room of a beautiful young woman another be ſubſtituted of a diſagreeable figure; or if the daughter of a free man marry his ſlave; or if any one give his ſlave to a free woman, pretending to her parents that he is his ſon or relation. In all theſe caſes the marriage is null and void; and all thoſe who have had any ſhare in making up the match are ſeverely puniſhed.

3. Any mandarin of letters is forbidden to form an alliance with any family reſiding in the province or city of which he is governor.

4. No Chineſe youth can enter into a ſtate of marriage during the time of mourning for his father or mother; and if promiſes have been made before, they ceaſe immediately on that event taking place. After the uſual time of mourning is expired, however, the parents of the intended bride are obliged to write to thoſe of the young man, putting him in mind of his engagement.

5. Marriage is alſo ſuſpended when a family experiences any ſevere misfortune, and even if a near relation were thrown into priſon; though this may be ſet aſide, provided the unfortunate perſon give his conſent.

6. Two brothers cannot marry two ſiſters; nor is a widower at liberty to marry his ſon to the daughter of a widow whom he chooſes for his own wife. A man is alſo forbidden to marry any of his own relations, however diſtant the degree of conſanguinity may be between them.

In China every father of a family is reſponſible for the conduct of his children, and even of his domeſtics; all thoſe faults being imputed to him which it was his duty to have prevented. Every father has the power of ſelling his ſon, “provided (ſays the law) the ſon has a right of ſelling himſelf.” This cuſtom, however, is barely tolerated among the middling and inferior ranks; and all are forbidden to ſell them to comedians, or people of infamous character, or very mean ſtations.

In China a ſon remains a minor during the whole lifetime, and is even liable for the debts contracted by his father, thoſe from gaming only excepted. Adoption is authoriſed by law, and the adopted child immediately enters into all the rights of a lawful ſon; only the law gives a right to the father of making a few diſpoſitions in favour of his real children. The children, however, whether adopted or not, cannot ſucceed to the dignity or titles of their father, though they may to his eſtate. The emperor alone can confer honours; and even then they muſt be reſigned when the perſon attains the age of 70; though this reſignation is conſidered as an advice rather than a law. The will of a father cannot be ſet aſide in China on account of any informality; nor can any mother in this empire make a will.

Though the Chineſe laws authoriſe ſlavery, yet the power of the maſter extends only to thoſe matters which concern his own ſervice; and he would be puniſhed with death for taking advantage of his power to debauch the wife of his ſlave.

By the laws of China huſbandmen are exempt from the payment of taxes after they have begun to till the earth to the beginning of harveſt.

72 Criminal laws in China. In criminal matters every perſon accuſed muſt be examined before five or ſix tribunals; and whoſe enquiries are directed not only againſt him, but againſt his accuſer, and the witneſſes that appear in the cauſe. He is, however, obliged to remain in priſon during the proceſs: "but (ſays M. Groſier) the Chineſe priſons are not horrible dungeons like thoſe of ſo many other nations; they are ſpacious, and have even a degree of convenience. One of the mandarins is obliged to inſpect them frequently; and this he does with the greater punctuality, as he muſt anſwer for thoſe who are ſick. He is obliged to ſee them properly treated, to ſend for phyſicians, and to ſupply them with medicines at the emperor's expence. If any of them dies, he muſt inform the emperor, who perhaps will order ſome of the higher mandarins to examine whether the former has diſcharged his duty faithfully or not.

73 Method of inflicting the baſtinado. The ſlighteſt puniſhment in China is the baſtinado; and the number of blows is to be determined by the degree of the offender's guilt. Twenty is the loweſt number; and in this caſe the puniſhment is conſidered as having nothing infamous in it, but being only a ſimple paternal correction. In this way the emperor ſometimes orders it to be inflicted on his courtiers; which does not prevent them from being afterwards received into favour, and as much reſpected as before. Every mandarin may inflict the baſtinado when any one forgets to ſalute him, or when he ſits in judgment in public. The inſtrument of correction is called *pan-tſee*, and is a piece of bamboo a little flatted, broad at the bottom, and poliſhed at the upper extremity, in order to manage it more eaſily with the hand. When the puniſhment is to be inflicted, the magiſtrate ſits gravely behind a table, having on it a bag filled with ſmall ſticks, while a number of petty officers ſtand around him, each furniſhed with theſe *pan-tſees*, and waiting only for his ſignal to make uſe of them. The mandarin then takes out one of the little ſticks contained in the bag, and throws it into the hall of audience. On this the culprit is ſeized and ſtretched out with his belly towards the ground; his breeches are pulled down to his heels, and an athletic domeſtic applies five ſmart blows with his *pan-tſee*. If the judge draws another ſmall ſtick from the bag, another officer ſucceeds, and beſtows five more blows; and ſo on until the judge makes no more ſignals. When the puniſhment is over, the criminal muſt throw himſelf on his knees, incline his body three times to the earth, and thank the judge for the care he takes of his education.

74 The cangue, or wooden collar. For faults of a higher nature, the carrying of a wooden collar, called by the Portugueſe the *cangue*, is inflicted. This machine is compoſed of two pieces of wood hollowed out in the middle, which, when put together, leave ſufficient room for the neck. Theſe are laid upon the ſhoulders of the criminal, and joined together in ſuch a manner, that he can neither ſee his feet nor put his hands to his mouth; ſo that he is incapable of eating without the aſſiſtance of another. This diſagreeable burden he is obliged to carry day and night; its weight is from 50 to 200 pounds, according to the enormity of the crime, to which the time of carrying it is alſo proportioned. For robbery, breaking the peace, or diſturbing a family, or being a notorious gambler, it is generally carried three months. During all this time the criminal is not allowed to take ſhelter in his own houſe, but is ſtationed for a certain ſpace of time, either in ſome public ſquare, the gate of a city or temple, or perhaps even of the tribunal where he was condemned. On the expiration of his term of puniſhment, he is again brought before the judge, who exhorts him in a friendly manner to amend; and after giving him 20 ſound blows diſcharges him.

75 Baniſhment, &c. Baniſhment is infliction for crimes of a nature inferior to homicide, and the duration is often for life, if the criminals be ſent into Tartary. Some culprits are condemned to drag the royal barks for three years, or to be branded in the cheeks with a hot iron, indicating the nature of their tranſgreſſions. Robbery between relations is more ſeverely puniſhed than any other; and that is accounted the moſt atrocious where younger brothers or nephews appropriate to themſelves beforehand any part of the ſucceſſion in which they have a right to ſhare with their elder brothers or nephews.

76 Puniſhment of informers againſt parents, &c. Information againſt a father or mother, grandfather or grandmother, uncle or eldeſt brother, even though the accuſation be juſt, is puniſhed with 100 blows of the pan-tſee, and three years baniſhment. If the accuſation be falſe, it is puniſhed with death. Deficiency in proper filial reſpect to a father, mother, grandfather, or grandmother, is puniſhed with 100 blows of the pan-tſee; abuſive language to theſe relations is death by ſtrangling; to ſtrike them is puniſhed by beheading; and if any one preſumes to hurt or maim them, his fleſh is torn from his bones with red hot pincers, and he is cut into 1000 pieces. Abuſing an elder brother is puniſhed with 100 blows of the pan-tſee; ſtriking him, with the puniſhment of exile.

77 Capital puniſhments, how inflicted. Homicide, even though accidental, is puniſhed with death in China. A rope about ſix or ſeven feet in length, with a running nooſe, is thrown over the criminal's head; and a couple of domeſtics belonging to the tribunal pull it ſtrongly in different directions. They then ſuddenly quit it, and in a few moments give a ſecond pull; a third is ſeldom neceſſary to finiſh the buſineſs. Beheading is accounted in China the moſt diſhonourable of all puniſhments, and is reſerved only for deſperate aſſaſſins, or thoſe who commit ſome crime equally atrocious with murder. To be cut in a thouſand pieces is a puniſhment inflicted only upon ſtate criminals or rebellious ſubjects. It is performed by tying the criminal to a poſt, ſcalping the ſkin from the head, and pulling it over the eyes. The executioner then tears the fleſh from different parts of the un-

unhappy wretch's body; and never quits this horrible employment till mere fatigue obliges him to give over: the remains of the body are then left to the barbarous ſpectators, who finiſh what he has begun. Though this puniſhment, however, has been inflicted by ſome emperors with all the dreadful circumſtances juſt mentioned, the law orders only the criminal's belly to be opened, his body to be cut into ſeveral peices, and then thrown into a ditch or river.

The torture, both ordinary and extraordinary, is uſed in China. The former is applied to the hands or feet: for the hands, ſmall pieces of wood are applied diagonally between the fingers of the criminal; his fingers are then tied cloſe with cords, and he is left for ſome time in that painful ſituation. The torture for the feet is ſtill worſe. An inſtrument, conſiſting of three croſs pieces of wood, is provided, that in the middle being fixed, the others moveable. The feet of the criminal are then put into this machine, which ſqueezes them ſo cloſe that the ancle bones become flat. The extraordinary torture conſiſts in making ſmall gaſhes in the body, and then tearing off the ſkin like thongs. It is never applied but for ſome great crime, ſuch as treaſon, or where the criminal's guilt has been clearly proved, and it is neceſſary to make him diſcover his accomplices.

78
M. Groſier's general view of the Chineſe laws.

Notwithſtanding thoſe dreadful puniſhments, M. Groſier is at great pains to prove that the laws of the Chineſe, with regard to criminal matters, are extremely mild. "One law (ſays he) will no doubt appear exceedingly ſevere and rigorous; it inflicts the puniſhment of death on thoſe who uſe pearls. Thoſe who read the hiſtory of China will be apt to fall into certain miſtakes reſpecting the penal laws of that nation. Some of its ſovereigns have indulged themſelves in gratifying ſanguinary caprices which were not authoriſed by the laws, and which have often been confounded with them: but theſe princes are even yet ranked among the number of tyrants, and their names are ſtill abhorred and deteſted throughout the whole empire. The Chineſe, in their criminal procedure, have a great advantage over all other nations: it is almoſt impoſſible that an innocent man ſhould ever become a victim to a falſe accuſation: in ſuch caſes the accuſer and witneſs are expoſed to too much danger. The ſlowneſs of the proceſs, and the numberleſs reviſions it undergoes, are another ſafeguard for the accuſed. In ſhort, no ſentence of death is ever carried into execution until it has been approved and confirmed by the emperor. A fair copy of the whole proceſs is laid before him; a number of other copies are alſo made out, both in the Chineſe and Tartar languages, which the emperor ſubmits to the examination of a like number of doctors, either Tartars or Chineſe. When the crime is of great enormity, and clearly proved, the emperor writes with his own hand at the bottom of the ſentence, "When you receive this order, let it be executed without delay." In caſes where the crime, though puniſhable by death according to law, is ranked in the ordinary claſs, the emperor writes at the bottom of the ſentence, "Let the criminal be detained in priſon, and executed in autumn;" that being the ſeaſon in which they are generally executed, and all on the ſame day.

79
Caſes in which crimes may be pardoned.

The emperor of China never ſigns an order for the execution of a criminal till he has prepared himſelf by faſting. Like other monarchs he has the power of giving pardons; but in this reſpect is much more limited than any other. The only caſes in which the Chineſe monarch can remit the puniſhment inflicted by law, are, 1. To the ſon of a widow who has not married again; 2. To the heir of an ancient family; 3. The deſcendents of great men or citizens who have deſerved well of their country; and, 4. laſtly, the ſons, or grandſons of a mandarin, who has become illuſtrious, and diſtinguiſhed himſelf by faithfully diſcharging the duties of his office. Neither a child, nor a man of very advanced age, can be cited before a tribunal. The ſon of a very aged father and mother is pardoned, if private property or the public peace be not hurt by giving him a pardon; and if the ſons of ſuch a father and mother be all guilty, or accomplices in the ſame crime, the youngeſt is pardoned in order to comfort his parents.

In China the accuſed are always treated with tenderneſs and lenity, being accounted innocent until their guilt be clearly proved; and even then, liberty excepted, they are ſcarce allowed to want for any thing. A jailor is puniſhed who behaves rigorouſly towards his priſoners; and the judges muſt likewiſe anſwer at their peril for any additions to the ſeverity of the law: depoſition being the ſlighteſt puniſhment inflicted upon them.

Subſtitution is ſometimes allowed by the laws of China; ſo that the near relation of a guilty perſon may put himſelf into the criminal's place, provided, however, that the chaſtiſement be ſlight, and the accuſed his ancient friend. The ſons, grandſons, wife, and brothers of a baniſhed Chineſe, are allowed to follow him into exile; and the relations of all perſons are permitted to viſit them in priſon, and to give them every aſſiſtance in their power; to do which good offices they are even encouraged, inſtead of being prevented.

80
Of the cities and their government.

Every city in China is divided into different quarters, each of which is ſubjected to the inſpection of a certain officer, who is anſwerable for whatever paſſes in the place under his juriſdiction. Fathers of families, as we have already obſerved, are anſwerable for the conduct of their children and domeſtics. Neighbours are even obliged to anſwer for one another, and are bound to give every help and aſſiſtance in caſes of robbery, fire, or any accident, eſpecially in the night-time. All the cities are furniſhed with gates, which are barricaded on the commencement of night. Centinels are alſo poſted at certain diſtances throughout the ſtreets, who ſtop all who walk in the night, and a number of horſemen go round the ramparts for the ſame purpoſe, ſo that it is almoſt impoſſible to elude their vigilance by favour of the darkneſs. A ſtrict watch is alſo kept during the day time; and all thoſe who give any ſuſpicion by their looks, accent, or behaviour, are immediately carried before a madarin, and ſometimes even detained until the pleaſure of the governor be known.

Private quarrels do not often happen in China, and it is rare that they are attended with a fatal iſſue. The champions ſometime decide the quarrel with their fiſts, but moſt frequently refer the caſe to a mandarin, who very often orders them both a ſound drubbing. None but military people are permitted to wear arms in public; and this privilege is extended even to them only during the time of war, or when they accompany a mandarin, mount guard, or attend a review. Proſtitutes are not allowed to remain within the walls of a city, or to keep a houſe of their own even in the ſuburbs. They may, however, lodge in the houſe of another: but that other is accountable for every diſturbance which may happen on their account.

81 Borrowing of money.

In all the Chineſe cities, and even in ſome of their ordinary towns, there is an office where money may be borrowed upon pledges at the common rate of the country; which, however, is no leſs than 30 *per cent.* Every pledge is marked with a number when left at the office, and muſt be produced when demanded; but it becomes the property of the office if left there a ſingle day longer than the term agreed upon for the payment of the money. The whole tranſaction remains an inviolable ſecret; not even the name of the perſon who leaves the pledge being inquired after.

82 Of the Chineſe roads.

Great attention is paid by the adminiſtration of China to the conveniency of travellers. The roads are generally very broad, all of them paved in the ſouthern provinces, and ſome in the northern; but neither horſes nor carriages are allowed to paſs along theſe. In many places valleys have been filled up, and rocks and mountains cut through, for the purpoſe of making commodious high ways, and to preſerve them as nearly as poſſible on a level. They are generally bordered with very lofty trees, and in ſome places with walls eight or ten feet high, to prevent travellers from going into the fields; but openings are left in proper places, which give a paſſage into croſs roads that lead to different villages. Covered ſeats are erected on all the great roads, where travellers may ſhelter themſelves from the inclemency of the weather; temples and pagods are alſo frequent, into which travellers are admitted without ſcruple in the day-time, but often meet with a refuſal in the night. In theſe mandarins only have a right to reſt themſelves as long as they think proper. There is, however, no want of inns on the great roads, or even the croſs ones in China; but they are ill ſupplied with proviſions: and thoſe who frequent them are even obliged to carry beds along with them to ſleep on, or elſe take up with a plain mat.

Towers are erected on all the roads of this great empire, with watch-boxes on the top, with flag-ſtaffs, for the convenience of ſignals, in caſe of any alarm. Theſe towers are ſquare, and generally conſtructed of brick, but ſeldom exceed twelve feet in height. They are built, however, in ſight of one another, and are guarded by ſoldiers, who run with great ſpeed from one to another, carrying letters which concern the emperor. Intelligence of any remarkable event is alſo conveyed by ſignals; and thus the court is informed with ſurpriſing quickneſs of any important matter. Thoſe which are built on any of the roads conducting to court, are furniſhed with battlements, and have alſo very large bells of caſt iron. According to law theſe towers ſhould be only five *lys*, about half a French league, diſtant from one another.

83 Method of conveyance.

There is no public poſt-office in China, though ſeveral private ones have been eſtabliſhed; but the couriers and offices charged with diſpatches for the empire have only a right to make uſe of them. This inconvenience, however excepted, travellers find conveyance very eaſy from one part of China to another. Great numbers of porters are employed in every city, all of whom are aſſociated under the conduct of a chief, who regulates all their engagements, fixes the price of their labour, receives their hire, and is reſponſible for every thing they carry. When porters are wanted, he furniſhes as many as may be neceſſary, and gives the ſame number of tickets to the traveller; who returns one to each porter when they have conveyed their loads to an appointed place. Theſe tickets are carried back to the chief, who immediately pays them from the money he received in advance. On all the great roads in China there are ſeveral offices of this kind, which have a ſettled correſpondence with others; the travellers therefore have only to carry to one of theſe offices a liſt of ſuch things as they wiſh to have tranſported: this is immediately written down in a book; and though there ſhould be occaſion for two, three, or four hundred porters, they are inſtantly furniſhed. Every thing is weighed before the eyes of their chief, and the hire is five pence per hundred weight for one day's carriage. An exact regiſter of every thing is kept in the office; the traveller pays the money in advance, after which he has no occaſion to give himſelf any farther trouble: on his arrival at the city he deſigns, his baggage is found at the correſponding office, and every thing is delivered to him with the moſt ſcrupulous exactneſs.

84 Cuſtom-houſes.

The cuſtom-houſes are here regulated by the general police of the country; and according to M. Groſier's account, theſe cuſtom-houſe officers are the moſt civil in the world. They have no concern with any claſs of people but the merchants, whom they take care not to diſtreſs by any rigorous exactions; neither, though they have authority to do ſo, do they ſtop travellers till their baggage is examined, nor do they even require the ſmalleſt fee from them. Duties are paid either by the piece or the load; and in the former caſe credit is given to the merchant's book without aſking any queſtions. A mandarin is appointed by the viceroy of each province to inſpect the cuſtom-houſes of the whole diſtrict; and the mandarins have alſo the care of the poſt-offices.

85 Money of the empire.

In former times the only money uſed in China was made of ſmall ſhells, but now both ſilver and copper coin are met with. The latter conſiſts of round pieces about nine-tenths of an inch (A) in diameter, with a ſmall ſquare hole in the middle, inſcribed with two Chineſe words on one ſide, and two Tartar ones on the other. The ſilver pieces are valued only by their weight. For the convenience of commerce, the metal is therefore caſt into plates of different ſizes; and for want of ſmall coin, a Chineſe always carries about

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(A) The Chineſe foot is longer by one hundredth part than the French, and the inch is divided into ten parts.

about him his ſcales, weights, and a pair of ſciſſars to cut the metal. This operation is performed by putting the ſilver between the ſciſſars, and then knocking them againſt a ſtone till the pieces drop off. In giving of change, however, people have no right to value ſilver by the numerical value of copper, this being entirely regulated by the intrinſic value of the metals. Thus, an ounce of ſilver will ſometimes be worth 1000 copper pieces, and ſometimes only 800; and thus the copper money of China may frequently be ſold for more than it would paſs for in commerce. The emperor would loſe much by this recoinage, were he not the ſole proprietor of all the copper mines in China. It is, however, expreſsly forbidden to employ copper coin in any manufacture where it might be employed as plain copper, and it is alſo forbidden to be ſold for the purpoſe of melting: but, if the price of the metal has not fallen, the infraction of this law is not very ſeverely puniſhed. On the other hand, if the value of unwrought copper exceeds that of the coin, a quantity of the latter is iſſued out to reſtore the equilibrium.

To keep up a conſtant circulation of all the coin in the empire, the Chineſe government are attentive to preſerve an equilibrium between the proportional value of the gold and ſilver; that is, to regulate the intrinſic value of each in ſuch a manner that the poſſeſſor of ſilver may not be afraid to exchange it for copper, nor the poſſeſſor of copper for ſilver. The method uſed for this purpoſe is, when ſilver becomes ſcarce, to make all the payments for ſome time in ſilver; but if copper, to make them all for ſome time in that metal only.

86
Of the Chineſe commerce.

The commerce of China is under the inſpection of the tribunal of finances; but on this ſubject the Chineſe entertain an opinion quite different from that of the Europeans. Commerce, according to them, is only uſeful as far as it eaſes the people of their ſuperfluities, and procures them neceſſaries. For this reaſon they conſider even that which is carried on at Canton as prejudicial to the intereſt of the empire. "They take from us (ſay the Chineſe) our ſilks, teas, and porcelain: the price of theſe articles is raiſed through all the provinces: ſuch a trade therefore cannot be beneficial. The money brought us by Europeans, and the high-priced baubles that accompany it, are mere ſuperfluities to ſuch a ſtate as ours. We have no occaſion for more bullion than what may be neceſſary to anſwer the exigencies of government, and to ſupply the relative wants of individuals. It was ſaid by Kouan-tſe, two thouſand years ago, That the money introduced does not enrich a kingdom in any other way than as it is introduced by commerce. No commerce can be advantageous long, but that which conſiſts in a mutual exchange of things neceſſary or uſeful. That trade, whether carried on by barter or money, which has for its object the importing of articles that tend to the gratification of pride, luxury, or curioſity, always ſuppoſes the exiſtence of luxury: but luxury, which is an abundance of ſuperfluities among certain claſſes of people, ſuppoſes the want of neceſſaries among a great many others. The more horſes the rich put to their carriages, the greater will be the number of thoſe who are obliged to walk on foot; the larger and more magnificent their houſes are, ſo much the more confined and wretched muſt thoſe of the poor be; and the more their tables are covered with a variety of diſhes, the more muſt the number of thoſe increaſe who are reduced to the neceſſity of feeding upon plain rice. Men, united by ſociety in a large and populous kingdom, can employ their induſtry, talents, and economy, to no better purpoſe than to provide neceſſaries for all, and procure convenience for ſome."

87
Hiſtory of the trade with Ruſſia.

The only commerce conſidered by the Chineſe as advantageous to their empire, is that with Ruſſia and Tartary; by which they are ſupplied with thoſe furs ſo neceſſary in the northern provinces. The diſputes concerning the limits of the reſpective empires of Ruſſia and China ſeem to have paved the way to this commerce. Theſe diſputes were ſettled by treaty on the 27th of Auguſt 1689, under the reign of Ivan and Peter Alexiowitz. The chief of the embaſſy on the part of Ruſſia was Golovin governor of Siberia; and two Jeſuits were deputed on the part of the emperor of China; and the conferences were held in Latin, with a German in the Ruſſian ambaſſador's train, who was acquainted with that language. By this treaty the Ruſſians obtained a regular and permanent trade with China, which they had long deſired, but in return they yielded up a large territory, beſides the navigation of the river Amour. The firſt intercourſe had taken place in the beginning of the 17th century; at which time a ſmall quantity of Chineſe merchandize was procured by ſome Ruſſian merchants from the Kalmuck Tartars. The rapid and profitable ſale of theſe commodities encouraged certain Siberian Wayvodes to attempt a direct and open communication with China. For this purpoſe ſeveral deputations were ſent to the emperor; and though they failed of obtaining the grant of a regular commerce, their attempts were attended with ſome conſequences of importance. Thus the Ruſſian merchants were tempted to ſend traders occaſionally to Peking; by which means a faint connection was preſerved with that metropolis. This commerce, however, was at laſt interrupted by the commencement of hoſtilities on the river Amour; but after the concluſion of the treaty in 1689, was reſumed with uncommon alacrity on the part of the Ruſſians: and the advantages thence ariſing were found to be ſo conſiderable, that a deſign of enlarging it was formed by Peter the Great. Ibrand Ides, a native of the duchy of Holſtein, then in the Ruſſian ſervice, was therefore diſpatched to Peking in 1692; by whoſe means the liberty of trade, before confined to individuals, was now extended to caravans. In the mean time, private merchants continued to trade as before, not only with the Chineſe, but alſo at the head quarters of the Mogul Tartars. The camp of theſe roving Tartars, which was generally ſtationed near the confluence of the Orhon and Toala rivers between the ſouthern frontiers of Siberia and the Mogul deſert, thus became the ſeat of an annual fair. Complaints, however, were ſoon made of the diſorderly behaviour of the Ruſſians: on which the Chineſe monarch threatened to expel them from his dominions entirely, and to allow them neither to trade with the Chineſe nor Moguls. This produced another embaſſy to Peking in 1719, when matters were again adjuſted to the ſatisfaction of both parties. The reconciliation, was of no long duration; for the Ruſſians having ſoon renewed their diſorderly behaviour, an order for their expulſion was iſſued in 1722, and all intercourſe between the two nations forbidden. The differences were once more made up in 1727, and a caravan allowed to go to Peking once in three years, provided it conſiſted of no more than 100 perſons; and that during their ſtay their expences ſhould not, as formerly, be defrayed by the emperor of China. The Ruſſians at the ſame time obtained permiſſion to build a church within the precincts of the caravanſary; and that four prieſts were allowed to reſide at Peking for the celebration of divine ſervice; the ſame indulgence being granted to ſome Ruſſian ſcholars, for the purpoſe of learning the Chineſe language, and qualifying themſelves for being interpreters between the two nations. This intercourſe continued till the year 1755; ſince which time no more caravans have been ſent to China. It was firſt interrupted by a miſunderſtanding betwixt the two courts; and though that difference was afterwards made up, no caravans have been ſent ever ſince. The empreſs of Ruſſia, ſenſible that the monopoly of the fur trade (which was entirely confined to the caravans belonging to the crown, and prohibited to individuals) was prejudicial to commerce, gave it up in favour of her ſubjects in 1762; and the centre of commerce betwixt the two nations is now at Kiatka. Here the trade is entirely carried on by barter. The Ruſſians are prohibited from exporting their own coin; finding it more advantageous to take goods in exchange than to receive bullion at the Chineſe ſtandard. The principal exports from Ruſſia are furs of different kinds; the moſt valuable of which are thoſe of ſea-otters, beavers, wolves, foxes, martins, ſables, and ermines; the greater part of which are brought from Siberia and the newly diſcovered iſlands; but as they cannot ſupply the demand, there is a neceſſity for importing foreign furs to Peterſburgh, which are afterwards ſent to Kiatka. Various kinds of cloth are likewiſe ſent to China, as well as hardware, and live cattle, ſuch as horſes, camels, &c. The exports from China are, raw and manufactured ſilk, cotton, porcelain, rhubarb, muſk, &c. The government of Ruſſia likewiſe reſerves to itſelf the excluſive privilege of purchaſing rhubarb. It is brought to Kiatka by ſome Bukharian merchants, who have entered into a contract to ſupply the crown with it in exchange for furs: the exportation of the beſt rhubarb is forbidden under ſevere penalties, but yet is procured in ſufficient quantities, ſometimes by clandeſtinely mixing it with inferior roots, and ſometimes by ſmuggling it directly. Great part of Europe is ſupplied with rhubarb from Ruſſia.

88 Emperor's revenue. The revenue of the emperor of China amounts to more than 41 millions ſterling; and might eaſily be increaſed, did the ſovereign incline to burden his ſubjects with new impoſitions. The annual expences of government are indeed immenſe, but they are regulated in ſuch a manner as never to be augmented but in caſes of the utmoſt neceſſity; it even happens very often that adminiſtration makes greater ſavings every year. When this happens to be the caſe, the ſurplus ſerves to increaſe the general treaſure of the empire, and prevents the neceſſity of new impoſitions in time of war, or other public calamities. The greater part of the taxes are paid in kind; thoſe, for inſtance, who breed ſilk worms, pay their taxes in ſilk, the huſbandmen in grain, the gardeners in fruits, &c. This method, at the ſame time that it is exceedingly convenient for the ſubject, is no way detrimental to the public intereſt. There are numbers of people every where in the ſervice of government, who are thus furniſhed with food and clothing; ſo that the commodities collected as taxes are almoſt conſumed in the provinces where they are levied; what remains is ſold for the behoof of the emperor, and the money depoſited in the imperial treaſury. The taxes paid in money ariſe principally from the cuſtoms and ſale of ſalt (which belongs entirely to the emperor), from the duties paid by veſſels entering any port, and from other impoſts on various branches of manufactures. Excepting theſe, the trader ſcarcely contributes any thing to the exigencies of the ſtate, and the mechanic nothing at all; the whole burden of taxation thus falling upon the huſbandman. This burden is regulated in proportion to the extent and fertility of his lands; and the greateſt care has been taken to manage matters ſo, that he may neither be overcharged in the impoſition nor haraſſed in the levying of the duties. "The regiſtering of lands (ſays M. Groſier), ſo often and to no purpoſe projected in France, has been long practiſed in this empire, notwithſtanding its prodigious extent."

89 Of the taxes in China. The levying of taxes in China is as ſimple as the nature of the thing will admit of. The duties levied from towns and villages are carried to cities of the third claſs; then they are conducted to thoſe of the ſecond; then to thoſe of the firſt; and at laſt to the capital. The levying and impoſition of taxes is ſubmitted to the tribunal of finances; and matters are ſo managed, that beſides the conſumption in each diſtrict for diſcharging the ordinary expences of government, ſomething is left by way of reſerve for anſwering accidental demands, and to be ready in caſes of neceſſity. This ſum becomes gradually leſs from the capital to cities of the firſt, ſecond, and third claſs. A proper ſtatement of what is paid in the provinces, of what is reſerved in the different cities, or contained in the different treaſuries of the empire, is ſubjected to the examination of the grand tribunal of finances. This reviſes the whole, and keeps an exact account of what is conſumed, and of whatever ſurplus may be left.

90 Of lending money, and deficiencies in paying intereſt. Lending money upon intereſt has been in uſe in China for about 2000 years. It has often been aboliſhed, and as often eſtabliſhed. The intereſt, as has been already hinted, is no leſs than 30 *per cent.* and the year is only lunar. A tenth part of this intereſt is paid monthly; and concerning neglects of payment, the following laws have been enacted. "However much the debt may have accumulated by months or years, the principal and intereſt ſhall remain always the ſame. Whoever infringes this law ſhall receive 40 blows of a *pan-tſee*; or an hundred, if he uſes any artifice to add the principal and intereſt together." This law is explained by the following. "Whoever ſhall be convicted before a mandrain of not having paid a month's intereſt, ſhall receive ten blows; twenty for two months, and thirty for three; and in this manner as far as ſixty; that is to ſay, to the ſixth month. The

debtor is then obliged to pay principal and intereſt; but thoſe who obtain payment by uſing violence and force, are condemned to receive 24 blows.

Many Chineſe writers have endeavoured unſucceſsfully to ſhow why government ſhould allow ſuch exorbitant intereſt to be taken for money; but the moſt ſatisfactory and rational account ſeems to be, that the great intereſt of money prevents the rich from purchaſing much land; as landed eſtates would only embarraſs and impoveriſh them, their produce being ſo much inferior to that of money. The patrimony of a family in China is ſeldom divided; and it never happens there, as in almoſt every other country, that wealth and riches are engroſſed by one part of the nation, while the other poſſeſſes nothing.

91 Agriculture greatly encouraged.

Agriculture is by the Chineſe conſidered as the firſt and moſt honourable of all profeſſions; ſo that in this empire the huſbandman enjoys many and great privileges, while the merchant and mechanic are much leſs eſteemed. Part of the crop is allowed to be uſed in diſtillation; but if the harveſt happens to be bad, this operation is prohibited.

92 Ceremony of the emperor tilling the earth with his own hands.

In China, the tillage of the earth is not only encouraged by law, but alſo by the example of the emperor, who annually tills the earth with his own hands. The beginning of ſpring in China is always reckoned to be in the mouth of February; but it belongs to the tribunal of mathematics to determine the preciſe day. The tribunal of ceremonies announces it to the emperor by a memorial; in which every thing requiſite to be done by him is mentioned with the moſt ſcrupulous exactneſs. The ſovereign then names 12 of the moſt illuſtrious perſons in his court to accompany him, and to hold the plough after he has performed his part of the ceremony. Among theſe there are always three princes of the blood, and nine preſidents of ſupreme courts; and if any of them are too old and infirm to undergo the fatigue, the ſubſtitutes muſt be authoriſed by the emperor. The feſtival is preceded by a ſacrifice, which the emperor offers up to *Chang-ti* (the ſupreme God); after which he and his attendants prepare themſelves by three days faſting and continence. Others are appointed by the emperor, on the evening before the ceremony, to go and proſtrate themſelves at the ſepulchre of his anceſtors, and to acquaint them, that, on the day following, he intends to celebrate a grand ſacrifice. This is offered up on a ſmall mount a few furlongs diſtant from the city, which, by the indiſpenſable rules of the ceremony, muſt be 50 feet in height. The Chang-ti is invoked by the emperor, who ſacrifices under the title of ſovereign pontiff, and prays for an abundant harveſt in favour of his people. He then deſcends, accompanied by the three princes and nine preſidents who are to put their hands to the plough along with him; the field ſet apart for this purpoſe being at a ſmall diſtance from the mount. Forty labourers are ſelected to yoke the oxen, and to prepare the ſeeds which the emperor is to ſow; and which are of five different kinds, viz. wheat, rice, two kinds of millet, and beans. They are brought to the ſpot in magnificent boxes, carried by perſons of the moſt diſtinguiſhed rank. The emperor then lays hold of the plough, and turns up ſeveral furrows, the princes of the blood do the ſame, and then the preſidents; after which the emperor throws into the furrows the five kinds of ſeeds already mentioned: laſtly, four pieces of cotton-cloth, proper for making dreſſes, are diſtributed to each of the labourers, who aſſiſt in yoking the oxen and preparing the ſeeds; and the ſame preſents are made to 40 other perſons who have only been ſpectators of the ceremony.

93 Of the peaſants.

“ We muſt not (ſays M. Groſier) judge of the Chineſe peaſants from thoſe of Europe, eſpecially in what relates to the lights acquired by education. Free ſchools are very numerous in every province of China, and even ſome of the villages are not deſtitute of this advantage. The ſons of the poor are there received as readily as thoſe of the rich; their duties and their ſtudies are the ſame; the attention of the maſters is equally divided between them; and from this obſcure ſource talents often ſpring, which afterwards make a conſpicuous figure on the grand ſtage of life. Nothing is more common in China than to ſee the ſon of a peaſant governor of that province in which his father had long toiled in cultivating only a few acres. The father himſelf, if taken from his plough, and elevated to a ſuperior ſphere, might, by reviving the inſtruction he received in his youth, and eſpecially if he be endowed with genius, find himſelf fully competent for his new employment.”

94 Groſier's defence of the Chineſe from the charge of murdering and expoſing their children.

The Chineſe have been greatly reproached with the inhuman practice of murdering their children; but though our author cannot deny that they are guilty of this practice, he excuſes them by ſaying, that “ the crime when committed in China is commonly owing to the fanaticiſm of idolatry; a fanaticiſm which prevails only among the loweſt of the people. It is either in obedience to the oracle of a bonze, to deliver themſelves from the power of magic ſpells, or to diſcharge a vow, that theſe infatuated wretches precipitate their children into the river: they imagine that, by doing ſo, they make an expiatory ſacrifice to the ſpirit of the river. All nations of antiquity almoſt have diſgraced themſelves by the like horrid practices; but the Chineſe are far from countenancing this barbarity on that account. Beſides, theſe criminal ſacrifices are never practiſed but in certain cantons of China, where the people, blinded by idolatry, are the dupes of prejudice, fanaticiſm, and ſuperſtition.—It often happens alſo, that the bodies of thoſe children which are ſeen floating on the water have not been thrown into it till after their death; and this is likewiſe the caſe with thoſe which are found in the ſtreets, or lying near the public roads. The poverty of the parents ſuggeſts this diſmal reſource, becauſe their children are then buried at the expence of the public. Expoſing of children in public places is a cuſtom tolerated in China; and government employs as much vigilance to have them carried away in the morning, as it beſtows care on their education. This is certainly giving people intimation to expoſe their children in the night-time, and no doubt encourages the practice: but the dictates of humanity are here united to thoſe of ſound policy. No law in China authoriſes mutilation: there are indeed eunuchs in the empire, but their number is much leſs than what it is generally ſuppoſed to be by Europeans. The greater part of the eunuchs belonging to the emperor and empreſſes have no higher employment than that of ſweeping the courts of juſtice.”

95 Gazette of Peking. Like the capital cities of European kingdoms, Peking, the metropolis of the Chineſe empire, is furniſhed with a gazette, which circulates into the remoteſt provinces, and which is even conſidered by adminiſtration as an eſſential part of the political conſtitution. It is printed daily at Peking, and contains an account of all thoſe objects to which the attention of adminiſtration is directed. In this gazette may be ſeen the names of all thoſe mandarins who are ſtripped of their employments, and the cauſes of their diſgrace; it mentions alſo the names of all thoſe delinquents who are puniſhed with death; of the officers appointed to fill the places of the diſgraced mandarins; the calamities which have afflicted any of the provinces; the relief given by government; and the expences incurred by adminiſtration for the ſubſiſtence of the troops, ſupplying the wants of the people, repairing or erecting public works; and, laſtly, the remonſtrances made to the ſovereign by the ſuperior tribunals, either with regard to his public deciſions or private conduct, and ſometimes even with regard to both. Nothing, however, is contained in this gazette that has not immediately come from the emperor, or been ſubmitted to his inſpection; and immediate death would be the conſequence of inſerting a falſehood in this miniſterial paper.

96 Seals of the emperor, mandarins, &c. No law or ſentence, as has already been ſaid, is of any force, until the emperor's ſeal has been affixed to it. This is about 8 inches ſquare, and is made of fine jaſper, a kind of precious ſtone much eſteemed in China; of which only the emperor is allowed to have a ſeal. Thoſe given to princes as marks of honour are compoſed of gold; the ſeals of the viceroys and great mandarins, of ſilver; while thoſe of inferior mandarins and magiſtrates are made only of lead or copper. The ſize of thoſe ſeals is greater or ſmaller according to the rank their poſſeſſors hold in the tribunals or as mandarins; and when any of them happens to be worn out, intimation muſt be ſent to the next ſuperior tribunal; on which a new one is ſent, and the old one muſt then be delivered up. The commiſſion of every inſpector ſent into the provinces muſt alſo be confirmed by the emperor's ſeal. The duty of theſe officers is to examine into the conduct of governors, magiſtrates, and private individuals; and inſtances are recorded of emperors themſelves aſſuming the office of inſpectors in ſome of the provinces. Theſe officers are not only ſuperior to all the magiſtrates, but even to the viceroys of the provinces themſelves. When a ſuperior magiſtrate behaves ill to an inferior one, the former inſtantly becomes the priſoner of the inſpector, and is ſuſpended from his office until he has cleared himſelf from every imputation laid to his charge. The viceroy, however, is allowed to enjoy his office until the report of the inſpector has been tranſmitted to the emperor.

97 Power of the viceroys of provinces. Theſe viceroys are diſtinguiſhed by the title of *Tſong-tou*, and are always mandarins of the firſt claſs, poſſeſſing an almoſt unlimited power within their diſtricts. They march abroad with all the pomp of royal magnificence, never quitting their palaces, on the moſt trifling occaſion, without a guard of 100 men. A viceroy is the receiver-general of all the taxes collected in the province, tranſmitting them to the capital, after having reſerved what he judges neceſſary for the demands of his diſtrict. All law-ſuits muſt be brought before his tribunal; and he has the power of paſſing ſentence of death, but it cannot be put in execution without being firſt carried to the emperor. Every three years he ſends to court a report of the conduct of the mandarins ſubordinate to him; and according to the contents they are either continued or diſgraced. Thoſe of whom he makes an unfavourable report are puniſhed in proportion to their delinquency; while, on the other hand, thoſe who have the good fortune to be well reported, are rewarded in a ſimilar proportion.

98 Degradation of mandarins. The principal mandarins are ſometimes broke and diſmiſſed from all their employments, while others are only removed ſome degrees lower. Thoſe who have been degraded ten ſteps, run a great riſk of never being employed again. Theſe degraded mandarins are kept in perpetual remembrance of their misfortune, by being obliged to mention it in every public order they iſſue forth in their inferior ſtation; thus, "I, ſuch a mandarin, degraded one, two, three, *&c.* ſteps, command and order," *&c.* Over theſe inferior mandarins the inſpector of the province has a very unlimited authority, and can, by his own power, deprive them of their employments for a great offence; nor does he conſult the court, excepting where the immediate puniſhment of the criminal is not neceſſary. Every one of the mandarins, of whatever rank or denomination, is obliged, once in three years, to give in writing an exact account of the faults he has committed in the execution of his office. If he is a mandarin belonging to any of the four firſt claſſes, this confeſſion is examined at court, but if it is made by any of the inferior ones, it muſt be laid before the provincial tribunal of the governor. Government, however, is not ſatisfied even with this confeſſion; inquiry is made into the truth of it, and the conduct of the mandarin is ſcrutinized with the utmoſt ſeverity, the informations being ſubjected to the tribunal of mandarins; where they are carefully examined, the merits and demerits of thoſe ſubjected to this political inquiſition carefully balanced, and their names afterwards divided into three claſſes. The firſt conſiſts of thoſe for whom rewards and preferment are intended; the ſecond, for whom gentle reproof and admonition are thought neceſſary; and the third, of thoſe who are to be ſuſpended for ſome time, or removed altogether, from their offices. Of theſe laſt ſome are allowed to continue; but they receive no ſalary, and are not only deprived of all their emoluments, but even of their honours. If they have been guilty of any action tending to oppreſs the people, or to occaſion a famine or ſcarcity among the lower ranks, their puniſhment is not confined to diſmiſſion from their offices, but they are alſo criminally impeached. The family burying-place of every Chineſe is accounted ſacred; none dares cut down the trees with which it is overſhadowed until they become decayed with age; and even then, not until their condition has been atteſted by a mandarin: but for certain crimes againſt government or the people, the burying-place of a mandarin is raſed to the foundation. No kind of puniſhment, however, inflicted on a father, is ſuppoſed in the leaſt to affect the character of his ſon; and therefore, when the latter is aſked by the emperor concerning his family, he will perhaps

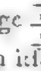
cooly anſwer, “ My father was diſgraced for ſuch a crime, my grandfather was beheaded for ſuch another,” without the acknowledgement being in the leaſt detrimental. On the contrary, by great and important ſervices, it is poſſible for him to wipe out theſe ſtains from the memory of his anceſtors.

Though the empire of China is governed by Tartar princes, the latter ſeem to beſtow much more care and attention on the Chineſe than their own natural ſubjects. Should any diſpute ariſe between a Chineſe and a Tartar, the former muſt have greatly deviated from the rules of juſtice, if he is not acquitted even by thoſe tribunals which are compoſed of half Chineſe and half Tartars. The ſlighteſt fault committed by a Tartar mandarin is always ſeverely puniſhed; but the puniſhment of the greateſt is often mitigated if the delinquent be a Chineſe; and the ſame ſeverity is exerciſed towards thoſe of the military department. Thoſe faults, however, are puniſhed with the greateſt ſeverity which hurt the intereſts of the people: for which reaſon they ſeldom fall a ſacrifice to that claſs of petty tyrants who in other countries prey upon and devour them. Every ſuperior mandarin is obliged to inform himſelf of the faults of his inferiors, and expoſe them; nay, he would be puniſhed for them himſelf if he did not.

99 Privileges of princes, &c. in China. Very little regard, as we have already had occaſion to obſerve, is paid to hereditary right in China. Even the princes of the blood enjoy no other privilege by birth but that of wearing a yellow girdle; and the names of their children, with the exact time of their birth, are inſcribed in a yellow book appropriated to that purpoſe. Collateral princes are diſtinguiſhed by an orange girdle, and their children are marked in a book of a red colour. The ſurnames of the princes of the reigning family are determined by the emperor alone; the reſt not being allowed to aſſume any name that too much reſembles thoſe of the Moguls or Chineſe. The rank even of the emperor's ſons diminiſhes one degree every generation; ſo that, at the ſeventh, only the eldeſt branch has a title to wear the yellow girdle, the reſt being ſunk into the rank of plain citizens. An hereditary ſovereignty, however, paſſes from one eldeſt ſon to another; and this title cannot be forfeited, unleſs the poſſeſſor be guilty of ſome crime. In this caſe the emperor appoints to the ſucceſſion either one of his younger brothers or a couſin; but theſe muſt be always choſen from the ſame branch, as the lawful branch cannot be deprived of its right without the condemnation of all who compoſe it. The only hereditary authority of the other princes exiſts among thoſe troops called the *Tartar bands*. There they enjoy, without oppoſition, that rank which they derive from their birth, but in every thing elſe are on a level with others. They are ſubjected to a military examination at ſtated periods, and are always promoted or degraded according to the degree of ſkill they exhibit. The ſame trial is undergone by the heir apparent and his ſons; the only indulgence ſhown them being, that ſchools are appointed for their particular uſe. The princes are likewiſe indulged with a tribunal appropriated on purpoſe for them, and before which alone they can be tried. An inſult offered to a prince decorated with the yellow girdle is puniſhed with death; but if he has omitted to put it on, the aggreſſor eſcapes with a baſtinading. A prince may be put to death by the emperor's conſent; but he eſcapes every ſlighter corporal puniſhment by paying a fine. Untitled princes have very few privileges ſuperior to thoſe of common citizens; and are generally very poor, unleſs poſſeſſed of ſome lucrative office. Thus they are ſometimes reduced to the neceſſity of accepting the higheſt pay of a common ſoldier in the Tartar bands. When they, or any of their children, however, enter into the marriage ſtate, the emperor uſually makes them a preſent of 100 ounces of ſilver. He will alſo relieve them on other occaſions, aſſiſt their widows and orphans, *&c.* but in all this never departs from the moſt exact rules of economy; ſo that the mandarins in this reſpect are much better than the relations of the ſovereign himſelf.

100 F. Amiot's account of the ancient religion of China. With regard to the ancient religion of China, F. Amiot informs us, that, after making every poſſible reſearch, comparing and reaſoning upon his obſervations, he at laſt concluded, that “ the Chineſe are a diſtinct people, who have ſtill preſerved the characteriſtic marks of their firſt origin; a people whoſe primitive doctrine will be found, by thoſe who take the trouble of inveſtigating it thoroughly, to agree in its eſſential parts with the doctrine of the choſen people, before Moſes, by the comand of God himſelf, had conſigned the explanation of it to the ſacred records; a people, in a word, whoſe traditional knowledge, when freed from whatever the ignorance or ſuperſtition of later ages has added to it, may be traced back from age to age, and from epocha to epocha, without interruption, for the ſpace of 4000 years, even to the renewal of the human race by the grandſon of Noah.” The *king*, or canonical books of the Chineſe, every where inculcate the belief of a Supreme Being, the author and preſerver of all things. Under him they mention the names of *Tien*, or Heaven; *Chang-tien*, or Supreme Heaven; *Chang-ti*, or Supreme Lord; and of *Hoang-chan-ti*, Sovereign and Supreme Lord: “ Names (ſays M. Groſier) correſponding to thoſe which we uſe when we ſpeak of God, the Lord, the Almighty, the Moſt High.”

According to the Chineſe books, the Supreme Being is the principle of every thing that exiſts, and the father of all living; he is eternal, immoveable, and independent; his power knows no bounds; his ſight equally comprehends the paſt, preſent, and the future, penetrating even into the inmoſt receſſes of the heart. Heaven and earth are under his government; all events, all revolutions, are the conſequences of his will; he is pure, holy, and impartial; wickedneſs offends his ſight; but he beholds with an eye of complacency the virtuous actions of men. Severe, yet juſt, he puniſhes vice in a ſtriking manner even on the throne, and often precipitates from thence the guilty, to place upon it the man who walks after his own heart, whom he hath raiſed from obſcurity. Good, merciful, and full of pity, he relents on the repentance of the wicked: public calamities, and the irregularities of the ſeaſons, are only ſalutary warnings, which his fatherly goodneſs gives to men to induce them to reform and amend.

The performance of religious worſhip at the proper and appointed times, has given occaſion to the great exactneſs with reſpect to the kalendar, which is remarkable throughout the empire of China; and all the celebrated emperors have begun their reigns with a reformation of it. Our hiſtorians, however, not contented with diſcovering in the Chineſe religion the fundamental principles of the ancient patriarchal religion, have alſo found in it evident ſymptoms of a knowledge of the Trinity as believed among Chriſtians. "Among the ancient Chineſe characters (ſays M. Groſier), which have eſcaped the ravages of time, we find the following △. According to the dictionary of *Kang-hi*, this ſignifies union; according to the *Chouc-ouen* (that book ſo highly eſteemed in China) △ is three united in one; it derives it from the characters *jou* (to enter or penetrate), and *ye*, one; whence it concludes, that △ means three united, penetrated, or incorporated into one. According to another book, accounted a learned and accurate explanation of the ancient characters, '△ ſignifies ſtrict union, harmony, the chief good of man, of heaven, and of earth; it is the union of the three *tſai* (powers, principles, or intelligencies); for, united, they direct, create, and nouriſh together. The image  (three united in one figure) is not ſo obſcure in itſelf; however it is difficult to reaſon upon it without being deceived: on this ſubject it is difficult to ſpeak.'

"Father Amiot, ſpite of all the objections which the critics of Europe may make, ſeems to conjecture, that the character △ might have been, among the ancient Chineſe, the ſymbol of the moſt holy Trinity; 'and the more ſo (he adds), as the ancient books furniſh a number of texts, which give us reaſon to ſuppoſe them to have been poſſeſſed of ſome knowledge of this ſublime myſtery.' The book *See-ki* ſays, 'The emperor formerly offered up a ſolemn ſacrifice every three years to the Spirit Trinity and Unity, *Chin-ſan-ye*.' The following celebrated text of *Lao-tſe* has long been known in Europe. '*Tao* is one by nature: the firſt begot the ſecond; two produced the third; the three created all things.'

"F. Amiot quotes another paſſage, which appears to be no leſs ſingular. 'He who is, as it were, viſible, and cannot be ſeen, is named *Khi*; he who may be heard, yet ſpeaketh not to the ears, is called *Hi*; he whom, in a manner, we feel, yet cannot touch, is named *Ouei*. In vain do we interrogate our ſenſes reſpecting theſe three: our reaſon, which alone can give us any ſatisfaction, will tell us that they make only one. Above there is no light; below there is no darkneſs. He is eternal; there is no name which can be given him. He reſembles nothing that exiſts; he is an image without figure; a figure without matter: his light is ſurrounded by darkneſs. If we look up to him above, we behold no beginning; if we follow him, we diſcover no end. From what the *Tao* hath been at all times, conclude what he is, viz. that he is eternal: he is the beginning of wiſdom.' The commentaries which explain this paſſage ſpeak in ſuch ſtrong and preciſe terms, that F. Amiot forbears to quote them, leſt he might incur the cenſure of too many incredulous readers."

101 Sacrifices. The ſacrifices of the Chineſe were firſt offered up in the open fields, or on ſome mountain, upon what they call the *Tan*, which ſignifies a quantity of ſtones thrown together in a round form, or ſimply a round heap of earth. A double fence, called *Kiao*, compoſed of turf and branches of trees, was raiſed around this; and, in the ſpace left between the two fences, two leſſer altars were erected on the right and left; upon which, immediately after the ſacrifice offered up to the *Tien*, they ſacrificed alſo to the *Cheng*, or good ſpirits of every rank, and to their virtuous anceſtors. The ſovereign alone had a right of ſacrificing upon this *Tan*; and the cuſtom of ſacrificing to inferior ſpirits, according to the Chineſe commentators, may be traced even to the days of *Fo-hi* himſelf. The ſame writers add, that, in addreſſing themſelves to the Chang-ti, they conſidered him as the ſovereign lord of the univerſe, clothed with all that power which was neceſſary to ſatisfy them with regard to the different objects of their requeſts; but that, in offering up their prayers to the inferior objects of worſhip, they only implored their protection and mediation with the Chang-ti.

While the empire was confined within narrow bounds, one mountain was ſufficient for the ſacrifices; but in proceſs of time it became neceſſary to conſecrate four others. Theſe were ſituated at the extremities of the empire, and were ſuppoſed to correſpond with the four quarters of the world; and the prince went ſucceſſively every year to one of theſe mountains to offer up ſacrifices; taking occaſion at the ſame time to ſhow himſelf to his people, and to inform himſelf of their wants. This cuſtom ſubſiſted for a long time; but at length it was found convenient to add a fifth mountain in the centre of the empire; and ever ſince theſe have been called the five *Yo*, or the five mountains of ſacrifice. This method of ſubjecting the emperor to regular annual journies could not but be attended with many inconveniences. It was found neceſſary on this account to conſecrate ſome ſpot in the neighbourhood of his palace, which might be ſubſtituted for the *Yo* upon all occaſions when the emperor could not repair to them. An edifice was therefore erected, which at once repreſented the *Kiao*, *Tan*, and the *Hall of Anceſtors*. This laſt was a neceſſary part of the edifice; becauſe it was incumbent on thoſe who offered up ſacrifices, firſt to repair to this hall, and acquaint their anceſtors with what they were about to perform; and thither alſo they returned after ſacrificing, to thank the ſame anceſtors for the protection they had received from the Chang-ti; after which they offered up a ſacrifice of thankſgiving in honour of them, and performed certain other ceremonies to ſhow their reſpect. The building contained five ſeparate halls, appropriated to different purpoſes: originally it had neither paintings nor ornaments of any kind, and a ſtair-caſe of nine ſteps conducted to the principal entrance. Afterwards, however, it was much more richly ornamented, each of the five halls being decorated with columns, over which others were placed that ſupported the ſecond roof. In ſucceeding times it was ſtripped of all its ornaments, with a view to bring back religion to its primitive ſimplicity. Its four gates were covered with fine moſs, repreſenting the branches of which the double fence of the ancient *Kiao* were formed. The ridge of the roof was covered with the ſame, and the whole was encompaſſed by a canal filled with water at the time of offering up the ſacrifices. To this a ſecond building was added, which they called the *temple of neatneſs*, and which was uſed only for purifications and ceremonies, the former being entirely conſecrated to the worſhip of the Chang-ti.

At preſent there are only two temples in Peking, named the *Tien-tan* and the *Ti-tan*; in the conſtruction of which all the elegance of Chineſe architecture is diſplayed. Theſe are both dedicated to the Chang-ti, but under different titles; in the one he is adored as the *eternal ſpirit*; in the other, as the creator and preſerver of the world. The ceremonies of the modern ſacrifices are greatly multiplied; and nothing can exceed the ſplendor and magnificence with which theſe ſolemnities are performed. Some time before the day appointed for the grand ceremony, the monarch, the grandees of the court, and all thoſe whom their employments qualify to aſſiſt at the ſolemnity, prepare themſelves by retirement, faſting, and continence; no audience is given by the emperor, and the tribunals are entirely ſhut; marriages, funerals, rejoicings, and entertainments of every kind, are then forbidden. At laſt, on the day appointed, the emperor appears attended by an innumerable multitude, and, his perſon ſurrounded by a vaſt number of princes, lords, and officers, while every part of the temple ſeems to correſpond with the magnificence of the ſovereign; all the vaſes and utenſils employed in the ſacrifices are of gold, and cannot be employed to any other purpoſe; even the inſtruments of muſic are of enormous magnitude, and never uſed any where elſe. All this grandeur, however, ſerves only to diſplay in a more eminent manner the humility and abaſement of the monarch during his devotion; at which time he rolls in the duſt, and ſpeaks of himſelf before the *Chang-ti* in terms of the moſt abject ſubmiſſion and humiliation.

102 Sect of Tao-ſſe.

The purity of the ancient Chineſe religion has, however, been long contaminated by many idolatrous and fanatical ſects. Among theſe, one named *Tao-ſſe* was founded by a philoſopher called *Lao-kiun* or *Lao-tſe*, who was born 603 B. C. He died in an advanced age, leaving to his diſciples a book intitled *Tao-te*, being a collection of 5000 ſentences. His morality has a great reſemblance to that of Epicurus. It conſiſts principally in baniſhing all vehement deſires and paſſions capable of diſturbing the peace and tranquillity of the ſoul. According to him, the care of every wiſe man ought to be only to endeavour to live free from grief and pain, and to glide gently down the ſtream of life devoid of anxiety and care. To arrive at this happy ſtate, he adviſes his followers to baniſh all thoughts of the paſt, and to abſtain from every vain and uſeleſs inquiry concerning futurity, as well as all tormenting thoughts of ambition, avarice, &c. It was found by the diſciples of this philoſopher, however, that all theſe endeavours to obtain a perfect tranquillity of mind were vain, as long as the thoughts of death intervened; they therefore declared it poſſible to diſcover a compoſition from which drink might be made that would render mankind immortal. Hence they were led to the ſtudy of chemiſtry; and, like the weſtern alchemiſts, wearied themſeves in ſearch of the philoſopher's ſtone, until at laſt they gave themſelves up to all the extravagancies of magic.

The deſire of avoiding death, together with the credulity natural to unenlightened minds, quickly produced a number of converts to the ſect of *Tao-ſſe*. Magical practices, the invocation of ſpirits, and the art of foretelling events by divination, quickly diffuſed themſelves over the empire, and the imbecillity of the emperors contributed to propagate the deception. Temples conſecrated to ſpirits quickly reared their heads in every corner of the empire; and two of the moſt celebrated of the ſect were authoriſed to maintain public worſhip there after the form which had been preſcribed by their maſter. At the ſame time they diſtributed, and ſold at a dear rate, images of the imaginary ſpirits with which they had peopled the heavens and the earth. Theſe were, by their command, worſhipped as ſo many deities independent of the Supreme Being; and, in like manner, ſeveral of the ancient emperors were invoked as gods.

Being patroniſed by the emperors of ſeveral dynaſties, this ſect became more and more powerful. At laſt they had the impudence to affix, during the night-time, to one of the gates of the imperial city, a book filled with myſtic characters and magical figures. At break of day they informed the emperor of the ſudden appearance of this book, and publicly declared that it was fallen from heaven. This trick eaſily impoſed upon the weak prince. He immediately repaired, with a numerous train, to the ſpot where the ſacred volume appeared; and having taken it into his hands in a reſpectful manner, carried it in triumph to his palace, where he ſhut it up in a golden box. Another emperor carried his reverence for the ſect to ſuch an height of impiety and extravagance, as to order a celebrated *Tao-ſſe* to be publicly worſhipped under the name of *Chang-ti*. The ſect thus patroniſed by the princes, and accommodated to the credulity of the vulgar, continued to gain ground in ſpite of every oppoſition from the wiſer part of the people, and is ſtill very powerful in China. At preſent they offer up three different victims, a hog, a fowl, and a fiſh, to a ſpirit whom they invoke. Various ceremonies, ſuch as howling, drawing fantaſtical figures upon paper, making an hideous noiſe with kettles and drums, are uſed in their incantations; and though it may readily be believed that they are for the moſt part unſucceſsful, yet their credit is ſtill kept up by thoſe caſes in which they ſucceed by accident.

The chief of the *Tao-ſſe* is inveſted by government with the dignity of grand mandarin, which is enjoyed by his ſucceſſors; he reſides in a ſumptuous palace in a town of Kiang-ſi; and the ſuperſtitious confidence of the people attracts an immenſe number thither from all parts of the empire. Some arrive in order to be cured of diſeaſes, others to get an inſight into futurity. The impoſtor diſtributes to them ſmall bits of paper filled with magical characters; and the ignorant wretches depart well ſatiſfied, without grudging the expence of their journey, though ever ſo long.

103 Of the worſhippers of Fo.

A ſtill more pernicious and more widely diffuſed ſect is that of the idol *Fo*, which came orignally from India. The *Tao-ſſe*, had promiſed to the brother of one of the emperors of China to introduce him to a communication with ſpirits. The credulous prince having heard of a great ſpirit named *Fo*, who reſided in India, prevailed on his brother to ſend an embaſſy thither. On the arrival of the ambaſſadors, however, they could find only two worſhippers of this diety, both of whom they brought to China. Several images of Fo were alſo collected at the ſame time; and theſe, together with ſome canonical books of the Indians, were placed on a white horſe, and carried in proceſſion to the imperial city.

This ſuperſtition was introduced into China about the 65th year of the Chriſtian æra, and ſoon made vaſt progreſs. One of its principal doctrines is that of the metempſychoſis, or tranſmigration of ſouls, of which M. Groſier thinks he was the inventor, and that Pythagoras, who travelled into ſeveral parts of India, had borrowed the doctrine from him. The account given of him by the bonzes is, that finding himſelf, at the age of 70, oppreſſed with infirmities, he called his diſciples together, and told them he was unwilling to leave the world without communicating the ſecret and hidden myſteries of his doctrine; which were, in ſhort, that all things had proceeded from a vacuum and nothing, and to that they muſt return. This doctrine produced a correſponding mode of action, or rather of inaction, in thoſe who believed it: for thus the great happineſs of man was made to conſiſt in abſolute annihilation; and therefore the nearer he could bring himſelf to this ſtate during life, the happier he was ſuppoſed to be.

The common doctrine, however, which admits of a diſtinction between good and evil, finds more proſelytes among the vulgar, whoſe ſituation in life will not allow them to ſpend their time in perpetual idleneſs. According to this, the righteous will be rewarded and the wicked puniſhed after death. They ſay alſo, that the god Fo came to ſave mankind, and to expiate their ſins; and that he alone can procure them a happy regeneration in the life to come. Five precepts are likewiſe inculcated on thoſe who adopt this doctrine: 1. Not to kill any living creature. 2. Not to take away the goods of another. 3. Not to pollute themſelves by uncleanneſs. 4. Not to lie; and, 5. Not to drink wine. Above all, they recommend to them to perform acts of mercy, to treat their bonzes well, build temples, &c.

The doctrine of metempſychoſis has introduced into China an infinite number of idols, who are all worſhipped on the ſuppoſition that the ſpirit of Fo has tranſmigrated into the animals they repreſent. Theſe idols, however, ſeem not to be worſhipped with great ſincerity; but, like the images of ſaints in the more ſuperſtitious countries of Europe, are beaten and thrown in the dirt when their votaries happen not to obtain their deſires, which they impute to the obſtinacy or weakneſs of the idol. Nay, M. Groſier gives an account of one man, who having ineffectually paid a ſum of money to the bonzes of a certain idol for the cure of his daughter, brought a formal accuſation againſt the idol itſelf; and in ſpite of all that the bonzes could ſay in its behalf, got its worſhip ſuppreſſed throughout the province.

104 Bad character of the bonzes.

The bonzes of China are repreſented as a moſt avaricious and hypocritical race of men, ready to practiſe every kind of villany, and even to ſubject themſelves to the moſt intolerable tortures, in order to obtain money from the compaſſion of the public when they cannot get it in any other way; and an edict of one of the emperors is cited by M. Groſier, by which great numbers of their religious houſes were ſuppreſſed. In order to perpetuate their ſect, they purchaſe young children, whom they take care to inſtruct in all the myſteries and tricks of their profeſſion; but excepting this, they are in general very ignorant, and few of them would be able to give any tolerable account of the tenets of their own ſect. They are not ſubject to a regular hierarchy, but acknowledge ſuperiors among them whom they call grand bonzes, who have the firſt place in all religious aſſemblies at which they happen to be preſent; and great profit is derived from certain religious clubs, both of men and women, at which the bonzes are always called to aſſiſt. Their wealth is likewiſe augmented by pilgrimages to certain places where there are temples more or leſs reverenced, and where a multitude of abſurd ceremonies are performed. Theſe bonzes, as may be eaſily imagined, are inveterate enemies to the progreſs of Chriſtianity, telling the moſt abſurd ſtories concerning the miſſionaries: as that they pluck out the eyes of their converts to conſtruct teleſcopes with, &c. The literati, however, and the more ſenſible part of the nation, hold them in the greateſt contempt.

105 Ridiculous ſuperſtition of the *fong-choui*.

We ſhall conclude this detail of the Chineſe religion with giving an account of one other ſuperſtition which ſeems peculiar to the nation. It is named *fong-choui*, which ſignifies wind and water. By this they mean the lucky or unlucky ſituation of a houſe, burying-place, &c. If any imprudent perſon has built a houſe cloſe to that of a Chineſe, in ſuch a manner that the angle formed by its roof flanks the wall or roof of the former houſe, the proprietor ever after lives in terror of utter ruin and deſtruction from the malignant influence of that angle. An implacable hatred inſtantly commences betwixt the two families, and often gives riſe to a law-ſuit, which furniſhes matter of diſcuſſion for ſome of the ſuperior tribunals. If no redreſs can be had at law, however, the Chineſe is then reduced to the neceſſity of erecting, on the top of his houſe, an enormous image of a dragon, or ſome other monſter, with its mouth gaping towards the angle, and, as it were, threatening to ſwallow it up; after which the apprehenſions of the proprietor begin to ſubſide, and tranquillity is reſtored to the family. In this manner the governor of *Kien-tchang* ſecured himſelf from the influence of the church of the Jeſuits, which, being built on an eminence, overlooked his palace. Not depending, however, entirely on the good offices of his tutelary dragon, he alſo took the wiſe precaution of altering his principal apartments, and raiſing, at the diſtance of 200 paces from the church, a kind of large facade three ſtories high. But unluckily the death of his ſucceſſor was attributed to this facade; for the mandarin being attacked with a diſorder in his breaſt, which made him ſpit up a white phlegm, this ſymptom was thought to be owing to the walls of the facade, which were very white, and which were forthwith painted black. The ſalutary precaution, however, happened to be taken too late; for the governor died notwithſtanding the black colour of the walls.

“ We ſhould never have done (ſays M. Groſier), were we to relate all the ſuperſtitious ideas of the Chineſe, reſpecting the lucky and unlucky ſituation of houſes, the quarter which doors ought to front, and the plan and day proper for conſtructing the ſtoves in which they cook their rice." But the object on which they employ their greateſt care is the choice of the ground and ſituation for a burying-place. Some quacks follow no other profeſſion than that of pointing out hills and mountains which have an aſpect favourable for works of that kind. When a Chineſe is perſuaded of the truth of ſuch information, there is no ſum which he would not give to be in poſſeſſion of the fortunate ſpot. The greater part of the Chineſe are of opinion that all the happineſs and misfortunes of life depend upon the *fong-choui.*

106 Jews and Mahometans in China.

A colony of Jews was eſtabliſhed in China about the year 206 B. C.; but they are now reduced to a ſmall number of families at Cai-fong, the capital of the province of Honan. The Mahometans have multiplied much more than the Jews. It is above 600 years ſince they firſt entered the empire, where they have formed different eſtabliſhments. At firſt their number was augmented only by marriages; but for ſome time paſt they have been more particularly attentive to the extending of their ſect and propogating their doctrine. The principal means employed for this purpoſe are, to purchaſe a great number of children brought up in idolatry, whom their poor parents are glad to part with; and theſe they circumciſe, and afterwards inſtruct in the principles of their religion. During the time of a famine which deſolated the province of Chang-tong, they purchaſed more than 10,000 of theſe children; for whom, when grown up, they procured wives, built houſes, and even formed whole villages of them. They are now become ſo numerous, that in the places where they reſide they entirely exclude every inhabitant who does not believe in their prophet, and frequent a moſque.

107 Ceremonies of marriage.

With regard to the manners of the Chineſe, they bear no reſemblance to thoſe of any other nation; and, if we may believe their hiſtorians, they are the ſame at this day that they were 4000 years ago. The women are condemned almoſt to perpetual impriſonment within the precincts of their own houſes, and are never ſeen even by their intended huſbands before marriage. He knows nothing of her looks or perſon but from the account of ſome female relation or confident, who in ſuch caſes acts the part of match-maker; though, if impoſed upon either with regard to her age or figure, he can have recourſe to a divorce. The ſame matrons who negociate the marriage, alſo determine the ſum which the intended huſband muſt pay to the parents of the bride: for in China a father does not give a dowry to his daughter; it is the huſband who gives a dowry to the wife. When the day appointed for the marriage is arrived, the bridge is placed in a chair or cloſe palanquin, the key of which is committed to the care of a truſty domeſtic, who muſt deliver it to none but the huſband. The latter richly dreſſed, waits at his gate for the arrival of the proceſſion. As ſoon as it approaches the key is put into his hands; he eagerly opens the chair, and for the firſt time perceives his good or bad fortune. If he is contented with his new ſpouſe, the bride deſcends and enters the houſe, where the marriage is concluded by feaſting and merriment as in other countries; but if the bridegroom is very much diſappointed, he ſuddenly ſhuts the chair, and ſends the bride home to her relations. To get rid of her in this manner, however coſts a ſum equal to what he originally gave in dowry to obtain her.

The Chineſe women, even of the firſt rank, ſeldom quit their apartment, which is ſituated in the moſt retired part of the houſe, and in which they are ſecluded from all ſociety but that of their domeſtics. The book of ceremonies requires that there ſhould be two apartments in every houſe; the exterior one for the huſband, the interior for the wife. They muſt even be ſeparated by a wall or wooden partition, the door of which is carefully guarded; nor is the huſband at liberty to enter the wife's apartment, or ſhe to quit it, without ſufficient reaſon. According to the ſame book, the prattling and loquacity of a woman are reckoned ſufficient grounds for a divorce. A woman, however, cannot be divorced on any account, if ſhe loſes her parents after marriage, or if ſhe has worn three years mourning for the loſs of her huſband, father, or mother.

A widow of any rank above the common, who has children, ſeldom enters a ſecond time into the marriage ſtate, though thoſe of the ordinary rank generally do. The poorer ſort are not at liberty to follow their own inclination, but are ſold for the behoof of the parents of the deceaſed. As ſoon as the bargain is concluded, a couple of porters bring a chair, which is guarded by a number of truſty people. In this the widow is ſhut up, and thus conducted to her new huſband.

"Maſters (ſays Mr Groſier), for the moſt part are very deſirous of promoting marriage among their ſlaves, whatever Mr *Paw* may ſay; who, without any foundation, has ventured boldly to aſſert the contrary. They have even very ſtrong motives to induce them to encourage theſe marriages; the children produced by them are ſtill their ſlaves; and beſides their becoming new property to them, the fathers and mothers are thus more ſtrongly attached to their ſervice."

108 Concubinage tolerated.

Concubinage is tolerated in China, though not authoriſed by any law. This privilege is granted only to the emperor, the princes of the blood, and mandarins; and none but the emperor is permitted to have more than one. The common people generally avail themſelves of the toleration granted them in this reſpect, and will have two or three concubines if they can afford it. They are, however, careful to excuſe themſelves as well as they can to their wives in this reſpect, pretending only a deſire of having many children, and a number of women to attend their wives. Others, deſirous of having a male child, which perhaps their lawful wife cannot have, take a concubine for this reaſon only, and diſmiſs her as ſoon as their wiſhes are accompliſhed: they then permit her to marry whom ſhe pleaſes, and frequently even provide a huſband for her themſelves. Theſe concubines are almoſt all procured from two cities named *Tang-tcheou* and *Sou-tcheou*, where they are educated, and taught ſinging, dancing, muſic, and every accompliſhment ſuitable to women of quality, or which can render them agreeable and pleaſing. The greater part of them are purchaſed in other places, to be again diſpoſed of; and this is the principal branch of trade carried on by theſe two cities. Unlawful intrigues are ſeldom heard of in China. Whoever ſeduces the wife of another is puniſhed with death: and the ſame puniſhment is generally inflicted on the perſon who debauches a young woman.

109 Education of children.

From the accounts we have of the education of children in China, one might be apt to conclude, that, inſtead of being the ignorant ſuperſtitious race already deſcribed, they ought to be the moſt intelligent people in the world. The book of ceremonies directs the education of a child to commence as ſoon as it is born, and deſcribes exactly the qualities which its nurſe ought to have. She muſt ſpeak little, adhere ſtrictly to truth, have a mild temper, behave with affability to her equals, and with reſpect to her ſuperiors. The child is taught to uſe the right hand as ſoon as it can put its hand to its mouth, and then it is weaned. At ſix years of age, if a male, he is taught the numbers moſt in uſe, and made acquainted with the names of the principal parts of the world; at ſeven, he is ſeparated from his ſiſters, and no longer allowed to eat with them, nor to ſit down in their preſence; at eight, he is inſtructed in the rules of good breeding and politeneſs; at nine, he ſtudies the kalendar; at ten he is ſent to a public ſchool, where he learns to read, write, and caſt accounts; from 13 to 15 he is taught muſic, and every thing that he ſings conſiſts of moral precepts. It was formerly the cuſtom, that all the leſſons deſigned for the Chineſe youth were in verſe: and it is to this day lamented, that the ſame cuſtom is not followed, as their education has ſince been rendered much more difficult and laborious.

At the age of 15, the Chineſe boys are taught to handle the bow and arrow, and to mount on horſeback; at 20 they receive the firſt cap, if they are thought to deſerve it, and they are permitted to wear ſilk dreſſes ornamented with furs; but before that period they are not allowed to wear any other thing than cotton.

Another method of initiating children into the principles of knowledge in this empire is, by ſelecting a number of characters expreſſive of the moſt common objects, engraving or painting them ſeparately on ſome kind of ſubſtance, and, under the thing repreſented, putting the name, which points out to the children the meaning of the word.

As the Chineſe have no proper alphabet, they repreſent almoſt every thing by different characters. The labour of their youth, therefore, is intolerable; being obliged to ſtudy many thouſand characters, each of which has a diſtinct and proper ſignification. Some idea of their difficulties may be obtained from what we are told by F. Martini, who aſſures us, that he was under the neceſſity of learning 60,000 different characters before he could read the Chineſe authors with tolerable eaſe.

The book firſt put into the hands of the Chineſe children is an abridgment, which points out what a child ought to learn, and the manner in which he ſhould be taught. This volume is a collection of ſhort ſentences, conſiſting of three or four verſes each, all of which rhyme; and they are obliged to give an account in the evening of what they have learned in the day. After this elementary treatiſe, they put into their hands the four books which contain the doctrines of Confucius and Mencius. The ſenſe and meaning of the work is never explained to them until they have got by heart all the characters, that is to ſay, the *words* in the book: a method no doubt inconceivably diſguſting, and calculated utterly to deſtroy the genius of a boy, if he has any. While they are getting theſe characters by heart, indeed, they are likewiſe employed in learning to form them with a pencil. For this purpoſe they are furniſhed with large leaves of paper, on which are written or printed with red ink very big characters; and all they are required to do is to cover thoſe red characters with black ink, and to follow exactly their ſhape and figure: which inſenſibly accuſtoms them to form the different ſtrokes. After this they are made to trace other characters, placed under the paper on which they write. Theſe are black, and much ſmaller than the other. It is a great advantage to the Chineſe literati to be able to paint characters well; and on this account they beſtow great pains in forming the hands of young people. This is of the utmoſt conſequence to literary ſtudents in the examinations which they are obliged to undergo before they can be admitted to the firſt degree. Du Halde gives a remarkable, inſtance, *viz.* that "a candidate for degrees having, contrary to order, made uſe of an abbrevation in writing the character *ma*, which ſignifies an horſe, had the mortification of ſeeing his compoſition, though in other reſpects excellent, rejected merely on that account; beſides being ſeverely rallied by the mandarin, who told him that a horſe could not walk unleſs he had all his legs."

After the ſcholar has made himſelf maſter of the characters, he is then allowed to compoſe; but the ſubject of his compoſition is pointed out to him only by one word. Competitions are likewiſe eſtabliſhed in China, but moſt of them are of a private nature. Twenty or thirty families, who are all of the ſame name, and who conſequently have only one hall for the names of their anceſtors, agree among themſelves to ſend their children twice a month to this hall in order to compoſe. Each head of a family in turn gives the ſubject of this literary conteſt, and adjudges the prize; but this coſts him a dinner, which he muſt cauſe to be carried to the hall of competition. A fine of about ten pence is impoſed on the parent of each ſcholar who abſents himſelf from this exerciſe.

Beſides theſe private competitions, every ſtudent is obliged to compete at leaſt twice a-year under the inſpection of an inferior mandarin of letters, ſtyled *Hio-kouan*. It frequently happens alſo, that the mandarins of letters order theſe ſtudents to be brought before them, to examine the progreſs they have made in their ſtudies, to excite a ſpirit of emulation among them, and make them give ſuch application as may qualify them for any employment in the ſtate. Even the governors of cities do not think it below their dignity to take this care upon themſelves; ordering all thoſe ſtudents who reſide near them to appear before their tribunal once a month: the author of the beſt compoſition is honoured with a prize, and the governor treats all the candidates on the day of competion at his own expence. In every city, town, and village in China, there are ſchoolmaſters who teach ſuch ſciences as are known in that country. Parents poſſeſſed of a certain fortune provide maſters for their children, to attend and inſtruct them, to form their minds to virtue, and to initiate them in the rules of good breeding and the accuſtomed ceremonies, as well as to make them acquainted with the laws and hiſtory, if their age will admit. Theſe maſters have for the moſt part attained to one or two degrees among the literati, and not unfrequently arrive at the firſt employments of the ſtate.

The education of the Chineſe women is confined to giving them a taſte for ſolitude, and accuſtoming them to modeſty and ſilence; and, if their parents are rich, they are likewiſe inſtructed in ſuch accompliſhments as may render them agreeable to the other ſex.

110
Dreſs.

There is little diſtinction in China between the ordinary dreſs of men and women. Rank and dignity are diſtinguiſhed by certain acceſſary ornaments: and the perſon would be ſeverely chaſtiſed who ſhould preſume to aſſume them without being properly authoriſed. The dreſs in general conſiſts of a long veſt which reaches to the ground. One part of this veſt, *viz.* that on the left ſide, folds over the other, and is faſtened to the right by four or five ſmall gold or ſilver buttons, placed at a little diſtance from one another The ſleeves are wide towards the ſhoulder, growing narrower as they approach the wriſt, where they terminate in the form of a horſe ſhoe, covering the hands entirely, and leaving nothing but the ends of the fingers to be ſeen. Round their middle they wear a large gridle of ſilk, the ends of which hang down to their knees. From this griddle is ſuſpended a ſheath, containing a knife and two of thoſe ſmall ſticks which they uſe as forks. Below this robe they wear a pair of drawers, in ſummer made of linen, and in winter of ſatin lined with fur, ſometimes of cotton, and in ſome of the northern provinces of ſkins. Theſe are ſometimes covered with another pair of white taffety. Their ſhirts are always very ſhort and wide, of different kinds of cloth, according to the ſeaſon. Under theſe they wear a ſilk net to prevent it from adhering to the ſkin. In warm weather they have their necks always bare; when it is cold, they wear a collar made of ſilk, ſable, or fox's ſkin, joined to their robe, which in winter is trimmed with ſheep's ſkin, or quilted with ſilk and cotton. That of people of quality is entirely lined with beautiful ſable ſkins brought from Tartary, or with the fineſt fox's ſkin, trimmed with ſable; and in the ſpring it is lined with ermine. Above their robe they wear alſo a kind of ſur-tout with wide ſleeves, but very ſhort, which is lined in the ſame manner. The emperor and princes of the blood only have a right to wear yellow; certain mandarins have liberty to wear ſatin of a red ground, but only upon days of ceremony; in general they are clothed in black, blue, or violet. The common people are allowed to wear no other colours but blue or black; and their dreſs is always compoſed of plain cotton cloth.

111
Chineſe obliged by the Tartars to cut off their hair.

Formerly the Chineſe were at great pains to preſerve their hair; but the Tartars, who ſubdued them, compelled them to cut off the greater part of it, and to alter the form of their clothes after the Tartar faſhion. This revolution in dreſs was not effected without bloodſhed, though the conqueror at the ſame time adopted in other reſpects the laws, manners, and cuſtoms of the conquered people. Thus the Chineſe are painted as if bald, but they are not ſo naturally; that ſmall portion of hair which they preſerve behind, or on the tops of their heads, is all that is now allowed them. This they wear very long, and plait like a tail. In ſummer they wear a kind of cap ſhaped like an inverted cone, lined with ſatin, and covered with ratan or cane very prettily wrought. The top terminates in a point, to which they fix a tuft of red hair, which ſpreads over it, and covers it to the brims. This hair grows between the legs of a kind of cow, and is capable of taking any colour, eſpecially a deep red. This ornament is much uſed, and any perſon who chooſes may wear it.

The mandarins and literati wear a cap of the ſame form as the foregoing, only it is lined with red ſatin, and covered on the outſide with white. A large tuft of the fineſt red ſilk is fixed over it, which is ſuffered to hang down or wave with the wind. People of diſtinction generally uſe the common cap when they mount on horſeback or during bad weather; being better calculated to keep off rain, and ſhelter thoſe who wear it from the rays of the ſun. For winter they have another cap bordered with ſable, ermine, or fox's ſkin, and ornamented with a tuft of ſilk like the former. In theſe fur-trimmings they are very curious, ſometimes expending 40 or 50 ounces of ſilver upon them.

The Chineſe people of rank never go abroad without boots made of ſatin, or ſome other ſilk, and ſometimes of cotton, but always dyed. They have neither heel nor top, and are made to fit the foot with the greateſt exactneſs. When they travel on horſeback, however, they have others made of the ſkin of a cow or horſe made very pliable. Their boot-ſtockings are of ſilk ſtuff, quilted and lined with cotton, reaching above the top of their boot, and ornamented with a border of velvet or cloth. In ſummer they wear a cooler kind, and in their houſes a ſort of ſlippers made of ſilk ſtuff. The common people are contented with black ſlippers made of cotton cloth. The fan is alſo a neceſſary appendage of the Chineſe dreſs, and is reckoned equally neceſſary with the boots.

The dreſs of the women conſiſts of a long robe quite cloſe at top, and long enough to cover even their toes, with ſleeves ſo long that they would hang down upon the ground, did they not take care to tuck them up; but their hands are ſeldom ſeen. The colour of their dreſſes is entirely arbitary, but black and violet are generally choſen by thoſe advenced in life. The young ladies, like thoſe of Europe, make uſe of paint to give a bloom to their complections; but this, though not the ſame with the kind uſed in Europe, agrees with it in the effect of ſoon wrinkling the ſkin. Their general head-dreſs conſiſts in arranging their hair in ſeveral curls, among which are interſperſed ſmall tufts of gold or ſilver flowers. According to Du Halde, ſome of them ornament their heads with the image of a fabulous bird, concerning which many ſtories are told. This is made of copper or ſilver gilt, its wings extended and lying pretty cloſe to the head-dreſs, embracing the upper part of their temples, while the long ſpreading tail forms a kind of plume on the top of the head. Its body is directly over the head, and the neck and bill hang down, the former being joined to the body by a concealed hinge, in order that it may play freely, and move about on the leaſt motion of the head. The whole bird adheres to the head by means of the claws, which are fixed in the hair.

Ladies of quality ſometimes wear ſeveral of theſe birds made up into a ſingle ornament, the workmanſhip of which is very expenſive. Young ladies wear alſo a crown made of paſteboard, the fore-part of which riſes in a point above the forehead, and is covered with jewels. The reſt of the head is decorated with natural or artificial flowers, among which ſmall diamond pins are interſperſed. The head-dreſs of the ordinary claſs of women, eſpecially when they are advanced in years, conſiſts only of a piece of very fine ſilk wrapped round their heads.

112
Abſurd cuſtom of preventing the feet of female infants from growing.

All authors agree, that an abſurd cuſtom prevails throughout China of confining the feet of female infants in ſuch a manner that they are never allowed to grow to near their full ſize. The ſmallneſs of their feet is accounted ſuch a valuable beauty, that the Chineſe women never think they can pay too dear for it. As ſoon therefore as a female infant is born, the nurſe wraps up its feet in very tight bandages, and this torture muſt be endured until their feet have ceaſed to grow. So prevalent is the force of cuſtom, however, that as the child grows up ſhe voluntarily ſubmits to new tortures in order to accompliſh the purpoſe more effectually. Thus the Chineſe women are deprived almoſt entirely of the uſe of their feet; and are ſcarce able to walk, in the moſt aukward hobbling manner, for the ſhorteſt ſpace. The ſhoe of a full grown Chineſe woman will frequently not exceed ſix inches.

The Chineſe uſe white as the colour proper for mourning; and though a ſon cannot wear this while his father and mother are alive, he can uſe no other for three years after their death; and ever afterwards his clothes muſt be of one colour. The law has forbidden the uſe of ſilks and furs to children; and has even preſcribed the time when they are firſt to wear a cap. This is put upon their heads by the maſter of ceremonies himſelf, who addreſſes them in the following manner: "Conſider that you now receive the dreſs of thoſe who have attained to maturity, and that you ceaſe to be children; renounce therefore all childiſh thoughts and inclinations, aſſume a grave and ſerious deportment, apply with reſolution to the ſtudy of virtue and wiſdom, and endeavour to merit a long and happy life." "This ceremony (ſays M. Groſier), which may appear trifling, is attended with the happieſt effects. The Chineſe give a kind of importance to every thing which can inſpire youth with a taſte for morality and a love of good order. It might be uſeful to mankind at every fixed epocha of their lives, to remind them of thoſe new duties impoſed by each ſucceſſive change; but, by uniting the ſolemnity of a public ceremony to this inſtruction, it will make a deeper impreſſion, and remain much longer imprinted on their memories."

115
Exceſſive ceremoniousneſs of the Chineſe.

Nothing can appear more irkſome to an European than the multitude of ceremonies uſed on all occaſions by the Chineſe. An invitation to an entertainment is not ſuppoſed to be given with ſincerity until it has been renewed three or four times in writing. A card is ſent on the evening before the entertainment, another on the morning of the appointed day, and a third when every thing is prepared and the gueſts ready to ſit down to the table. The maſter of the houſe always introduces his gueſts into the hall, where he ſalutes them one after another. He then orders wine to be brought him in a ſmall cup made of ſilver, porcelain, or precious wood, and placed upon a ſmall varniſhed ſalver. He lays hold of it with both his hands, makes a bow to all the ſurrounding gueſts, and advances towards the fore-part of the hall, which generally looks into a large court. He there raiſes his eyes and the cup towards heaven; after which he pours the wine on the ground. He afterwards pours ſome wine into a ſilver or porcelain cup, makes a bow to the moſt conſiderable perſon in company, and then goes to place the cup on the table before him; for in China every gueſt has a table for himſelf. The perſon for whom he intends this honour, however, generally ſaves him the trouble of placing the cup; calls for wine in his turn, and offers to place the cup on the maſter's table, who endeavours to prevent him; with a thouſand apologies and compliments according to the rules of Chineſe politeneſs. A ſuperior domeſtic conducts the principal gueſt to an elbow chair covered with rich flowered ſilk, where the ſtranger again begins his compliments, and begs to be excuſed from ſitting in ſuch an honourable ſeat, which nevertheleſs he accepts of; and all the reſt of the gueſts do the ſame, otherwiſe the ceremonial would be gone through with each of them. The entertainment is concluded by ſome theatrical repreſentations, accompanied with the muſic of the country; which, however, would give but little pleaſure to an European. Beſides the gueſts, a certain number of people are admitted into the court in order to behold theſe theatrical repreſentations; and even the women are allowed to view them through a wicket, contrived ſo that they may behold them without being ſeen themſelves.

The entertainments of the Chineſe are begun, not by eating, but by drinking; and the liquor they drink muſt always be pure wine. The intendant, or *maitre de hotel*, falling down on one knee, firſt invites the gueſts to take a glaſs; on which each of them lays hold, with both hands, of that which is placed before him, raiſing it as high as his forehead, then bringing it lower down than the table, and at laſt putting it to his mouth; they all drink together, and very ſlowly, taking three or four draughts. While they are drinking, the diſhes on each of the tables are removed, and others brought in. Each of the gueſts has twenty-four ſet before him in ſucceſſion: all of them fat, and in the form of ragouts. They never uſe knives in their repaſts; and two ſmall-pointed ſticks, ornamented with ivory or ſilver, ſerve them inſtead of forks. They never begin to eat, however, until they are invited by the *maitre de hotel*; and the ſame ceremony muſt be gone through every time they are going to take a cup of wine or begin to a new diſh. Towards the middle of the entertainment the ſoup is brought in, accompanied with ſmall loaves or meat-pies. Theſe they take up with their ſmall ſticks, ſteep them in the ſoup, and eat them without waiting for any ſignal or being obliged to keep time with the reſt of the gueſts. The entertainment, however, continues in other reſpects with the utmoſt formality until tea is brought in; after which they retire from table and amuſe themſelves in another hall, or in the garden for a ſhort time, until the deſert be brought in. This, like the entertainment itſelf, conſiſts of 24 diſhes, which are made up of ſweatmeats, fruits differently prepared, hams and ſalted ducks which have been backed or dried in the ſun, with ſhell and other kinds of fiſh. The ſame ceremonies which preceded the repaſt are now renewed, and every one ſits down at the ſame place he occupied before. Larger cups are then brought in, and the maſter invites the gueſts to drink more freely.

Theſe entertainments begin towards evening, and never end till midnight. A ſmall ſum of money is given to the domeſtics; when every one of the gueſts goes home in a chair preceded by ſeveral ſervants, who carry large lanthorns of oiled paper, on which are inſcribed the quality, and ſometimes the name, of the maſter. Without ſuch an attendance they would be taken up by the guard; and the day following they never fail to return a card of thanks to the officer.

Their method of drinking tea is not like that of other nations. A ſmall quantity of bohea, ſufficient to tinge the water and render it palatable (for they drink no green), is taken in the morning, and thrown into a veſſel adapted to the number in family. This ſtands till milk warm; in which ſtate it is kept the whole day, and a cup drank now and then without ſugar or milk, in order to exhilerate the ſpirits when exhauſted by fatigue: and if a ſtranger call by accident, or a viſitor by appointment, the firſt thing preſented, after the uſual ceremonies of meeting, is a very ſmall pipe filled with tobacco of their own growth and a cup of the tea already mentioned, or of ſome freſh made of better quality, together with ſweetmeats, &c. Tea is the daily beverage in China, and is drank by all ranks of people.

Some change has been made in the ceremonial of the Chineſe by the Tartar conqueſt, and ſome new diſhes alſo introduced by the ſame means; and here M. Groſier obſerves, that the Tartars are much better cooks than the Chineſe. All their diſhes are highly ſeaſoned; and by a variation in the proportions of their ſpiceries, they are able to form a variety of diſhes out of the ſame materials. None of their viands, however, are more eſteemed than ſtags ſinews, and the neſts of a particular ſpecies of birds, which have the property of giving a moſt agreeable reliſh to whatever is mixed with them. Other diſhes are introduced at theſe repaſts, which would be accounted very diſagreeable with us; ſuch as the fleſh of wild horſes, the paws of a bear, and the feet of ſeveral wild animals. The greater part of theſe proviſions are brought preſerved in ſalt from Siam, Camboya, and Tartary.

114 Chineſe wines. The wines of China have no reſemblance to ours either in taſte or quality, being procured from rice and not from the vine. A particular kind of rice is employed for making them, and the grain is ſteeped for 20 or 30 days in water, into which ingredients of a different nature are ſucceſſively thrown: they afterwards boil it; and as ſoon as it becomes diſſolved by the heat, it immediately ferments, and throws up a vaporous ſcum not unlike new wine. A very pure liquor is found under this ſcum, which is drawn off and put into veſſels well glazed; From the remaining lyes an inflammable ſpirit is made, little inferior, and ſometimes even ſuperior to the European. Another kind of wine is uſed by the Chineſe, or rather Tartars, called *lamb-wine*. It is very ſtrong, and has a diſagreeable ſmell; and the ſame may be believed of a kind of ſpirit diſtilled from the fleſh of ſheep; though this laſt is ſometimes uſed by the emperors.

Theſe entertainments exceed the bounds of ordinary repaſts; the Chineſe being naturally ſober, and thoſe in eaſy circumſtances living chiefly on pork, for which reaſon a great number of hogs are bred in the country. Their fleſh is much eaſier of digeſtion, and more agreeable to the taſte, than thoſe of Europe. The Chineſe hams are in high eſtimation. The common people live very poorly; being ſatisfied, in time of ſcarcity, with the fleſh of dogs, horſes, cats, and rats, which laſt are ſold publicly in the ſtreets.

115 Public feſtivals. There are ſeveral public feſtivals annually celebrated in China. One is that already mentioned, in which the emperor tills the ground with his own hands. This is alſo celebrated on the ſame day throughout the empire. In the morning the governor of every city comes forth from his palace crowned with flowers, and enters his chair amidſt the noiſe of different inſtruments which precede it; a great number of people attending, as is uſual on all ſuch occaſions. The chair is ſurrounded by litters covered with ſilk carpets, on which are repreſented either ſome illuſtrious perſons who have ſupported and encouraged agriculture, or ſome hiſtorical painting on the ſame ſubject. The ſtreets are hung with carpets, triumphal arches are erected at certain diſtances, lanthorns every where diſplayed, and all the houſes illuminated. During the ceremony a figure reſembling a cow, made of baked earth, with gilt horns, is carried in proceſſion, and of ſuch enormous magnitude that 40 men are ſcarce ſufficient to ſupport it. A child follows with one foot naked and the other ſhod, who is called the *ſpirit of labour and diligence*, and keeps continually beating the image with a rod to make it advance. Labourers, with their implements of huſbandry, march behind; and the proceſſion is cloſed by a number of comedians and people in maſks. The governor advances towards the eaſtern gate, and returns in the ſame manner. The cow is then ſtripped of its ornaments, a prodigious number of earthen calves taken from its belly and diſtributed among the people, after which the large figure is broken in pieces and diſtributed in the ſame manner. The ceremony is ended by an oration in praiſe of agriculture, in which the governor endeavours to excite his hearers to the practice of that uſeful art.

Other two feſtivals are celebrated in China with ſtill more magnificence than that above deſcribed. One of them is at the commencement of the year; the other is called the *feaſt of lanthorns*. During the celebration the former, all buſineſs, whether private or public, is ſuſpended, the tribunals are ſhut, the poſts ſtopped, preſents are given and received, and viſits paid. All the family aſſemble in the evening, and partake of a feaſt to which no ſtranger is admitted; though they become a little more ſociable on the following day.

The feaſt of lanthorns ought to take place on the 15th day of the firſt month, but uſually commences on the evening of the 13th, and does not end till that of the 16th. At that time every city and village, the ſhores of the ſea, and the banks of all the rivers, are hung with lanthorns of various ſhapes and ſizes; ſome of them being ſeen in the courts and windows of the pooreſt houſes. No expence is ſpared on this occaſion; and ſome of the rich people will lay out eight or nine pounds ſterling on one lanthron. Some of theſe are very large compoſed of ſix wooden frames either neatly painted or gilt, and filled up with pieces of fine tranſparent ſilk, upon which are painted flowers, animals, and human figures; others are blue, and made of a tranſparent kind of horn. Several lamps, and a great number of wax candles, are placed in the inſide: to the corners of each are fixed ſtreamers of ſilk and ſatin of different colours, with a curious piece of carved work on the top. They are likewiſe acquainted with our magic lanthorn, which they ſometimes introduce in this feſtival. Beſides this they have the art of forming a ſnake 60 or 80 feet in length, filled with lights from one end to the other; which they cauſe twiſt itſelf into different forms, and move about as if it was a real ſerpent. During the ſame feſtival all the varieties of the Chineſe fire-works, ſo juſtly admired, and which, ſome time ago at leaſt, ſurpaſſed every thing of the kind that could be done in Europe, are exhibited.

116 Magnificence of the viceroys.

Every public ceremony in China is carefully rendered as ſtriking as poſſible. A viceroy never quits his palace but with a royal train, dreſſed in his robes of ceremony, and carried in a chair elegantly gilt, which is born upon the ſhoulders of eight domeſtics; two drummers marching before the guards, and beating upon copper baſons to give notice of his approach. Eight other attendants carry ſtandards of wood varniſhed, upon which are inſcribed in large characters all his titles of honour. After theſe come 14 flags with the ſymbols of his office; ſuch as the dragon, tyger, phoenix, flying tortoiſe, &c. Six officers follow, each bearing a piece of board in ſhape like a large ſhovel, on which are written in large golden characters the qualities of the mandarin himſelf: two others carry, the one a large umbrella of yellow ſilk, and the other the cover in which the umbrella is kept. The firſt guards are preceded by two archers on horſeback; the latter are followed by others armed with a kind of weapons compoſed of hooked blades, fixed perpendicularly to long poles ornamented with four tufts of ſilk, placed at a ſmall diſtance above one another. Behind theſe are two other files of ſoldiers, ſome of whom carry large maces with long handles; others iron maces in the ſhape of a ſnake; others are armed with huge hammers; while thoſe behind them carry long battle-axes in the form of a creſcent: others follow, who have battle-axes of another kind; and behind theſe are ſome with the hooked weapons already deſcribed.

Behind theſe come ſoldiers armed with triple-pointed ſpears, arrows, or battle-axes; having in front two men who carry a kind of box containing the viceroy's ſeal. Then come two other drummers to give notice of his approach. Two officers follow, having on their heads felt-hats, adorned with plumes of feathers, and each armed with a cane to recommend regularity and good order to the ſurrounding multitude. Two others bear maces in the form of gilt dragons. Theſe again are followed by a number of magiſtrates and officers of juſtice; ſome of whom carry whips or flat ſticks, while others have chains, hangers, and ſilk ſcarfs. Two ſtandard-bearers and a captain command this company, which immediately precedes the governor. His chair is ſurrounded by pages and footmen, and an officer attends him who carries a large fan in form of a ſcreen: he is followed by ſeveral guards differently armed, together with enſigns and other officers, who are alſo followed by a great number of domeſtics all on horſeback, carrying various neceſſaries for the uſe of the mandarin. If he marches in the night-time, inſtead of flambeaux, as are cuſtomary in Europe, large lanthorns, exceedingly pretty, are carried before him; on the tranſparent part of which are written, in very conſpicuous characters, his quality, titles, and rank, as mandarin. Theſe are alſo intended to give notice to the paſſengers to ſtop, and to thoſe who are ſitting to riſe up with reſpect; for whoever neglects either the one or the other is ſure to receive a ſevere baſtinading.

The emperor marches with ſtill more magnificence, in proportion to his ſuperior quality. The trumpets uſed in his proceſſion are about three feet long, eight inches in diameter at the lower extremity, and pretty much reſembling a bell in ſhape: their ſound is peculiarly adapted to that of the drums. His cavalcade is cloſed by 2000 mandarins of letters and as many of arms. Sometimes the great mandarins, as well as the emperor, travel in barks. Their attendance is then ſomewhat different, but the magnificence almoſt the ſame. The honours paid to a viceroy who has governed a province with equity are exceedingly great on his departure from it. He has ſcarcely left the capital of the province when he finds on the highway, for the ſpace of two or three leaugues, tables ranged at certain diſtances, each of which is ſurrounded with a long piece of ſilk that hangs down to the earth. On theſe wax candles are placed even in the open day; perfumes are burnt upon them; and they are loaded with a profuſion of victuals and various kinds of fruit, while tea and wine are prepared for him on others. The people throw themſelves on their knees as he paſſes, and bow their heads even to the earth; ſome ſhed tears, or pretend to do ſo; ſome preſent him wine and ſweetmeats; others frequently pull off his boots and give him new ones. Theſe boots, which he has perhaps uſed only for a moment, are conſidered as a valuable monument: thoſe firſt taken off are preſerved in a cage over the gate of the city; the reſt are carefully kept by his friends.

117 Knaviſh diſpoſition of the Chineſe.

Hitherto our author, M. Groſier, has ſeemed inclined to give a favourable idea of the Chineſe, and to cauſe us look upon them as many degrees ſuperior to ourſelves in the practice of virtue and morality; but when he comes to give an account of their dealings in trade, he is then obliged to confeſs that they are as diſhoneſt and knaviſh a race as any that exiſt. "The moſt frequented fairs of Europe (ſays he) afford but a faint idea of that immenſe numbers of buyers and ſellers with which the large cities of China are continually crowded. We may almoſt ſay, that the one half are employed in over-reaching the other. It is, above all, againſt ſtrangers that the Chineſe merchants exerciſe, without any ſenſe of ſhame, their inſatiable rapacity. Of this F. du Halde gives a ſtriking example, which might be ſupported by many others: 'The captain of an Engliſh veſſel bargained with a Chineſe merchant at Canton for ſeveral bales of ſilk, which the latter was to provide againſt a certain time. When they were ready, the captain went with his interpreter to the houſe of the Chineſe merchant to examine whether they were ſound an in good condition. On opening the firſt bale, he found it according to his wiſh, but all the reſt were damaged and good for nothing. The captain on this fell into a great paſſion, and reproached the merchant in the ſevereſt terms for his diſhoneſty. The Chineſe, after having heard him for ſome time with great coolneſs, replied, 'Blame, Sir, your knave of an interpreter; he aſſured me that you would not inſpect the bales.'

"The lower claſs of people are, above all, very dexterous in counterfeiting and adulterating every thing they ſell. Sometimes you think you have bought a capon, and you receive nothing but ſkin; all the reſt has been ſcooped out, and the place ſo ingeniouſly filled, that the deception cannot be diſcovered till the moment you begin to eat it. The counterfeit hams of China have been often mentioned. They are made of a peice of wood cut in the form of a ham, and coated over with a certain kind of earth which is covered with hog's ſkin. The whole is ſo curiouſly painted and prepared, that a knife is neceſſary to detect the fraud. Mr Oſbeck relates, that having one day obſerved a blind man carrying about for ſale ſome of thoſe trees called by the Chineſe *Fo-kei*, he purchaſed one, which to appearance had fine double red and white flowers; but in a cloſer examination, he found that the flowers were taken from another tree, and that one calyx was ſo neatly fitted into the other, with nails made of bamboo, that he ſhould ſcarcely have diſcovered the deceit, had not the flowers begun to wither. The tree itſelf had buds, but not one open flower.

“ The robbers in China ſignalize themſelves alſo by their dexterity and ingenuity, which they diſplay in their profeſſion. They ſeldom have recourſe to acts of violence, but introduce themſelves into a houſe either privately or by forming ſome connection with the family. It is as difficult in China to avoid robbery as it is to apprehend the criminal in the fact. If we are deſirous of finding among the Chineſe openneſs of temper, benevolence, friendſhip, and, laſtly virtue, we muſt not ſeek for it in cities, but in the boſom of the country, among that claſs of men who have devoted themſelves to labour and agriculture. A Chineſe ruſtic often diſcovers moral qualities which would add a luſtre to the character of men of the moſt exalted rank. It appears that rural life naturally inſpires ſentiments of benevolence; by continually receiving the gifts of nature, the mind is enlarged, and men are inſenſibly accuſtomed to diffuſe them to thoſe around them.”

The internal commerce of China is much greater than that of all Europe; but its foreign trade is by no means equal to that of any of the grand European powers. Its internal commerce is greatly facilitated by the vaſt number of canals and rivers with which the country is interſected. The Chineſe, however, are not at all fitted for maritime commerce: Few of their veſſels go beyond the ſtraits of Sunda: their longeſt voyages to Malacca extend only as far as Acheen, towards the ſtraits of Batavia, and northward to Japan.

Their commerce with the laſt mentioned iſland, conſidering the articles of exchange which they procure at Camboya or Siam, produces them *cent. per cent.* Their trade with the Manillas brings only about 50 *per cent.* Their profit is more conſiderable about Batavia; and the Dutch ſpare no pains to invite them to traffic at their ſettlement. The Chineſe traders go alſo, tho' not very frequently, to Acheen, Malacca, Thor, Patan and Ligor, belonging to Siam and Cochin-china; from whence they bring gold and tin, together with ſome objects of luxury for the table. A great obſtacle to the foreign commerce of the Chineſe is their indifference about marine affairs, and the bad conſtruction of their veſſels. This they themſelves ackowledge: but ſay, that any attempt to remove it would be derogating from the laws, and ſubverting the conſtitution of the empire.

118 Burying-places deſcribed.

The burying-places in China are always ſituated at a ſmall diſtance from a city or town, and generally upon ſome eminence, having pines or cypreſſes uſually planted around them. The form of the tombs is various, according to the different provinces, and the ſituation of thoſe for whom they are intended. The coffins of the poor are placed under a ſhade covered with thatch, or incloſed in a ſmall building of brick in the form of a tomb. The tombs of the rich are ſhaped like a horſe-ſhoe, well whitened, and finiſhed with great taſte; but thoſe of the mandarins and people of quality are much more ſumptuous and elegant. A vault is firſt conſtructed, in which the coffin is ſhut up; over this vault is raiſed a pyramid of earth well beat together, about 12 feet in height and 10 in diameter. A layer of lime and ſand laid over this earth makes a kind of plaſter, which renders the whole very durable and ſolid; various kinds of trees being planted around it in regular order. Before it is placed a large and long table of white marble, on the middle of which are ſet a cenſer accompanied with two vaſes, and the ſame number of candleſticks of exquiſite workmanſhip. Beſides this, a great number of figures, repreſenting officers, eunuchs, ſoldiers, ſaddled horſes, camels, lions, tortoiſes, &c. are ranged round the tombs in different rows; which, F. du Halde aſſures us, produce a very ſtriking effect.

When a Chineſe dies in a province in which he was not born, his children have a right, nay it is their indiſpenſable duty, to tranſport the body to the burying place of their anceſtors. A ſon who ſhould be wanting in this reſpect, would be diſgraced, and his name never placed in the hall of his anceſtors. This is a vaſt building, conſidered as common to all the branches of the ſame family; and to which they all repair at a certain ſeaſon of the year. Sometimes they amount to ſeven or eight thouſand perſons, whoſe fortune, dignity, and rank in ſociety, are all very different; but there no diſtinction of rank is known; age only gives precedence, and the oldeſt always takes place of all the reſt, though he ſhould be the pooreſt in the company. The diſtinguiſhing ornament of this hall is a long table ſet againſt the wall, upon which is generally ſeen the image of one of their anceſtors, who has filled ſome office of diſtinction in the empire with honour to himſelf, or who has been rendered illuſtrious by his talents and abilities. Sometimes it only contains the names of men, women, and children belonging to the family inſcribed upon tablets, together with their age, the day of their death, and the dignities they enjoyed at that time. Theſe tablets are ranged in two rows upon ſteps, and are only about a foot high each. In the ſpring, and and ſometimes in the autumn, the relations of the deceaſed repair to this hall, where the only privilege enjoyed by the richeſt is that of preparing an entertainment, and treating the whole family at their own expences: but they never allow themſelves to taſte a bit of any thing until an offering has been firſt made to their anceſtors. This does not, however, excuſe them from viſiting the real tomb of their anceſtors once or twice a year, generally in the month of April. At this time they pluck the weeds and buſhes from around the tomb, renew their expreſſions of grief, and conclude by placing upon it wine and proviſions, which ſerve to dine their aſſiſtants.

119 Funeral ceremonies.

The funeral ceremonies are conſidered by the Chineſe as the moſt important of any. A few moments after a perſon has expired, he is dreſſed out in his richeſt attire, and adorned with every badge of his dignity; after which he is placed in the coffin. The preparation of a coffin, in which his body may be incloſed after death, is one of the chief objects of attention to a Chineſe during his life, and great expence is often thrown out upon it; inſomuch that the poor will give all they are worth, and the rich expend a thouſand crowns, nay, a ſon will ſell himſelf for a ſlave in order to purchaſe a coffin for his father. Sometimes the coffin, when purchaſed with all this labour and expence, will remain twenty years uſeleſs in the family, and is conſidered as the moſt valuable piece of furniture in his poſſeſſion.

The manner of interment is as follows; Firſt they ſprinkle ſome lime in the bottom of the coffin; then they lay the body in it, taking care to place the head on a pillow, and to add a great deal of cotton that it may remain more ſteady, and be prevented from ſhaking. In this manner the body remains expoſed ſeven days; but the time may be reduced to three, if any weighty reaſon makes it neceſſary; and, during this interval, all the relations and friends, who are purpoſely invited, come and pay their reſpects to the deceaſed, the neareſt relations remaining in the houſe. The coffin is expoſed in the hall of ceremony, which is then hung with white, but ſome pieces of black or violet coloured ſilk are here and there interſperſed, as well as ſome other ornaments of mourning. Before the coffin is placed a table, on which ſtands the image of the deceaſed, or a carved ornament inſcribed with his name: and theſe are always accompanied with flowers, perfumes, and lighted wax candles.

In the mean time thoſe who enter the hall are accuſtomed to ſalute the deceaſed as if he were ſtill in life. They proſtrate themſelves before the table, and knock their foreheads ſeveral times againſt the earth; after which they place on the table ſome perfumes and wax candles provided for the purpoſe. The ſalutation which they have made to the deceaſed is returned by the eldeſt ſon accompanied by his brothers. The latter come forth from behind a curtain, which hangs on one ſide of the coffin, creeping along the ground until they reach the ſpot where thoſe ſtand whom they are going to ſalute; after which, without riſing up, they return to the place from whence they came. The women are alſo concealed behind the ſame curtain, from whence they every now and then ſend forth diſmal cries.

After a number of ceremonies and invitations, the funeral proceſſion at laſt commences. A troop of men march in a file, carrying different figures made of paſte-board, and repreſenting ſlaves, lions, tigers, horſes, &c. Others follow, marching in two files; ſome of which carry ſtandards, ſome flags or cenſers filled with perfumes; while melancholy and plaintive airs are played by others on different muſical inſtruments. Theſe muſicians immediately precede the coffin, which is covered with a canopy, in form of a dome, of violet-coloured ſilk: its four corners are ornamented with tufts of white ſilk very neatly embroidered, and covered at the top with net-work. The coffin is placed on the bottom of this machine, and is carried by 64 men. The eldeſt ſon, clothed in a frock of canvas, having his body bent and leaning on a ſtaff, follows near the coffin; and behind him his brothers and nephews, but none of them clothed in canvas. Then come the relations and friends, all clad in mourning, and followed by a great number of chairs covered with white ſtuff, which contain the wives and female ſlaves of the deceaſed. Theſe make great ſhow of ſorrow by their doleful cries; but M. Groſier obſerves, that in ſpite of all they can do, the lamentations of the Chineſe are ſo methodical, that an European would be apt to conclude that they were the effects of art rather than the natural effuſions of a mind agitated and oppreſſed with grief. When they arrive at the burying place, the coffin is depoſited in a tomb appropriated for it, not far from which there are tables arranged in different halls, and on which the aſſiſtants are entertained with great ſplendour. The entertainment is ſometimes followed by freſh marks of homage to the corpſe; but theſe are often changed into thanks to the eldeſt ſon; who, however, anſwers only by ſigns. But if the deceaſed was a grandee of the empire, a certain number of his relations never leave the tomb for a month or two. There they reſide in apartments purpoſely provided for them, and every day renew their marks of grief in company with the children of the deceaſed. The magnificence of theſe funeral ceremonies is proportioned to the wealth or dignity of the deceaſed. That of one of the brothers of the emperor was attended by 16,000 people, each of whom had a particular office aſſigned him relating to the ceremony.

120 Mourning.

Mourning continues in China for three years; and during all this time they are obliged to abſtain from the uſe of fleſh and wine; nor can they aſſiſt at any entertainment of ceremony, or attend any public aſſembly. At firſt they are not even permitted to go abroad; and when they do ſo, they are carried in a chair covered with a white cloth. Sometimes the filial piety of the Chineſe is carried to ſuch a length, that they preſerve the bodies of their deceaſed fathers in their houſes for three or four years; and thoſe who do ſo impoſe alſo upon themſelves a great number of other duties, uſing no other ſeat during the day but a ſtool covered with white ſerge, and no other bed but a plain mat made of reeds, which is placed near the coffin.

121 Diverſions of hunting and fiſhing.

According to M Groſier, the only diverſions of the Chineſe are thoſe of hunting and fiſhing, dancing not being practiſed, and gaming forbidden by law. Fiſhing is conſidered by them rather as an object of commerce and induſtry than amuſement. They catch fiſh by various methods; uſing nets in their great fiſheries, but lines in the private. In certain provinces alſo they uſe a certain kind of bird, whoſe plumage greatly reſembles that of a raven, but with a much longer bill, very ſharp and hooked. This method of fiſhing is practiſed in boats, of which great numbers may be ſeen on the river about ſun-riſing, with the fiſhing-birds perched on their prows. Theſe birds are taught to catch fiſh almoſt in the ſame manner that dogs purſue game. The fiſhermen, after making ſeveral turns with their boats, beat the water ſtrongly with one of their oars. This ſerves as a ſignal to the birds, who inſtantly plunge into the water, and diving, ſwallow as many ſmall fiſh as they can, repairing immediately afterwards to the boat, and carrying a large one by the middle in their bill. The ſmall ones are prevented from paſſing into the ſtomach by a ring placed on purpoſe to confine its gullet: and thus the fiſherman by ſtroaking its neck with the head downwards, makes the bird diſgorge all thoſe ſmall fiſh it has ſwallowed. When they have done fiſhing, the rings are taken off, and the birds allowed to feed. When the fiſh happens to be too large for a ſingle bird, the others have ſagacity enough to aſſiſt it; one taking it by the tail, another by the head, &c. and thus they tranſport it to their maſter.

Another method of fiſhing, practiſed only in China, is as follows: They nail a board, about two feet in breadth, which is covered with a white ſhining kind of varniſh, upon the edges of a long narrow boat, from one end to the other. This board is placed in ſuch a manner as to ſlope almoſt imperceptibly to the water. It is uſed only in the night-time, and is always turned towards the moon, that the reflection of light from the luminary may increaſe the ſplendor of the varniſh. The fiſh, in ſporting, often miſtake this varniſhed board for water; and endeavouring to throw themſelves into it, fall into the boat.

The ſoldiers have a particular method of fiſhing with a bow and an arrow; the latter of which is fixed to the bow by a ſtring, both to prevent it from being loſt, and to enable them to draw out the fiſh which the arrow has pierced: others make uſe of tridents to catch large fiſh which are ſometimes found in the mud.

Beſides theſe diverſions, the Chineſe have ſome ſtrolling players, but no regular theatres; they have likewiſe muſicians and ſingers, but no operas, or indeed any public ſpectacle worthy of notice.

122
Of the Chineſe language.

The language of the Chineſe is not only very ancient, but, in M. Groſier's opinion, is ſtill ſpoken as in the moſt early ages without any variation. His reaſons for this opinion are, 1. We do not perceive in hiſtory, nor even in the moſt fabulous traditions, a ſingle fact tending to occaſion any doubt of the language ſpoken by the ancient Chineſe being different from that uſed at preſent. 2. China has never changed its inhabitants; and if revolutions have occaſioned any mixture of new languages, it appears that the ancient language has always been predominant, and that the new ſettlers have learned and ſpoken it, as the Marchew Tartars after their conqueſt. 3. The moſt intelligent and diſcerning of the literati agree, that the firſt chapters of the *Chou-king* were written under the reign of Yao 2300 years before Chriſt; and in theſe, ſeveral ſpeeches of the firſt emperors are related word for word; and it is not probable that the language of theſe princes was different from that of the hiſtorian. 4. A compliment paid to Yao by one of his ſubjects, with the anſwer of that prince, are ſtill preſerved, as well as two ſongs compoſed under the ſame reign. 5. The moſt ancient inſcriptions in China are all in the language ſpoken throughout the empire at this day. 7. The Chineſe have borrowed nothing from other nations; and their attachment to their own cuſtoms, and to antiquity, muſt undoubtedly be very unfavourable to any innovation. The language ſpoken by the vulgar, indeed, muſt have undergone ſome changes; but theſe may be accounted trivial, affecting only the pronunciation; which indeed appears to be varied in ſome few inſtances. It is certain, however, that the Chineſe players act theatrical pieces which were written 1000 years ago, and that theſe are ſtill underſtood throughout the empire.

The language of China has no alphabet; all the words which compoſe it conſiſt of one ſyllable only, and are very few in number. Theſe always remain the ſame, and continue monoſyllables even when two are joined together, being united in the ſame manner as the French words *bon* and *jour* are united to form *bon-jour*. Theſe monoſyllables never form but one ſound. When written by an European, they begin with the letters *ch, tch, f, g,* or *j, i, k, l, m, n, g, ng, p, ſ, ts, v, ou*; the final letters being *a, e, i, o, u, ou, u, l, n, gn*. The middle of Chineſe words conſiſts of vowels and conſonants producing only one ſound, and pronounced always as monoſyllables. The whole primary words of the language are in number only about 330, though ſome dictionaries make them 484. The ſenſe of theſe words, however, is varied by the accents and changes of the voice in pronouncing them almoſt *ad infinitum*. Two principal accents are known in China; the *ping*, that is *even*, without elevating or depreſſing the voice. This is divided into *tſing*, *clear*, and *tcho*, *obſcure*; or rather *open* and *mute*. The accent *tſe* is ſubdivided into *tchang*, ſharp, *kiu*, grave, and *jou* re-entering. The tone is *chang* when one raiſes the voice at the end of a word, as when the negative *ne* is pronounced with great emphaſis and force; it is *kiu* when one depreſſes the voice with an air of timidity. When the accent is *jou*, the voice is drawn back as it were into the throat; and the aſpiration which takes place on certain words beginning with the letters *c, k, p, t*, ſtill adds to theſe varieties.

By theſe differences in pronunciation the ſignification of the words is totally changed: thus the word *tchu* pronounced by lengthening the *u*, and with a clear tone of voice, ſignifies maſter or lord: if it is pronounced in an uniform tone by lengthening the *u*, it ſignifies *hog*: when pronounced lightly, and with rapidity, it ſignifies *kitchen*; and when articulated with a ſtrong voice depreſſed towards the end, it ſignifies a *pillar*.

By the conjunction and modification of theſe different monoſyllables, a Chineſe can expreſs every thing he has occaſion for; and it may be eaſily ſeen what variety muſt reſult from this art of multiplying words. The Chineſe language therefore has words expreſſive of the ſmalleſt variation of circumſtance, and which cannot be expreſſed in the European languages without a circumlocution. Thus, inſtead of the five words, calf, bull, ox, heifer, cow, every time that a cow has a calf ſhe acquires a new name in the language of this empire; and ſtill another when ſhe becomes barren. An ox fed for ſacrifice has a particular name, which is changed when he goes to the altar. In like manner, a whole dictionary might be compoſed of the words that are employed to expreſs the different parts of the emperor's palace, and thoſe that are in a manner conſecrated to it; others being employed when the palaces of princes or mandarins are ſpoken of. Thus the number of their characters are augmented beyond all bounds, ſo that the greater part of their literati ſpend all their lives in ſtudying them.

In the Chineſe there are four different languages. 1. The *Kou-ouen*, or claſſical language. This is not ſpoken at preſent, though it is generally believed to have been the language of the early ages. It is ſo laconic, and the ideas are ſo crowded, that it is very difficult to be underſtood; however, the literati, who can read and underſtand it, are much delighted with it. 2. The *Ouen-tchang* is the language uſed in compoſitions where a noble and elevated ſtyle is requiſite. It is never ſpoken, but certain ſentences and complimentary expreſſions are ſometimes borrowed from it. It approaches near to the laconic brevity and majeſtic ſublimity of the *Kou-ouen*, and is equally proper for every kind of ſubject, excepting only the ambiguities of metaphyſics, and the formal rugged diction uſed in treating of the abſtract ſciences.

3. The *Kouan-hoa* is the language of the court, of people in office, and of the literati. It admits of ſynonymous expreſſions to moderate the brevity of monoſyllables; of pronouns and relatives; prepoſitions, adverbs, and particles; to ſupply the want of caſes, moods, tenſes, and numbers, which have place in other languages.

4. *Hiang-tan* is a kind of corrupted language, or provincial dialect, ſpoken by the lower claſſes in China; and of which every province, city, and almoſt every village, has its own. Beſides the ſenſe of the words, which is changed in a great variety of places, they are ſo altered by diverſity of pronunciation as to be almoſt unintelligible.

123 Chineſe writing. There are five kinds of writing mentioned by the Chineſe literati; the moſt modern of which is a method of tracing out the characters with a pencil. This is difficult, and requires much experience; at any rate, it disfigures the characters greatly, and is therefore only uſed in the preſcriptions of phyſicians, prefaces to books, and inſcriptions of fancy. The tracing of characters with neatneſs and accuracy, however, as we have already had occaſion to obſerve, is greatly admired in China. They are often preferred to the moſt elegant painting; and ſome will give a moſt exorbitant price for a page of an old book, if it happens to be neatly written. They pay particular attention to well-formed characters even in the moſt common books; and if any of the leaves happen to fall off, will replace them with the greateſt attention. To apply them to any vile purpoſe, tread them under foot, &c. would be reckoned an unpardonable violation of decency and politeneſs; nay, it often happens, that workmen, ſuch as maſons and joiners, dare not tear a printed leaf of paper fixed to the wall.

Punctuation was not formerly uſed in China, nor are points as yet employed in works of an elevated ſtyle, or ſuch as are to be preſented to the emperor. 124 Of their poetry. Poetry is ſeldom any object of attention, though the taſte for it ſeems to be pretty general in China. Their verſification has its rules, and is no leſs difficult than that of other nations. Only the moſt harmonious, energetic, and pictureſque words, are to be employed, and they muſt always be uſed in the ſame ſenſe in which they were uſed by the ancients. Each verſe can contain only a certain number of words; all of which muſt be ranged according to the rules of quantity, and terminate in rhyme. The number of verſes in a ſtrophe is not determined; but they muſt be uniform, and preſent the ſame diſtribution of rhymes. The ſmall number of poetical expreſſions contained in the Chineſe language has rendered it neceſſary to extend the poetical licence to a great length in this reſpect. The Chineſe poets are allowed to employ a blank verſe in every four. They are acquainted with moſt kinds of poetry in uſe among us. They have ſtanzas, odes, elegies, idylls, eclogues, epigrams, ſatires, and even *bouts rimes*. The common people have alſo ballads and ſongs peculiar to themſelves. Some of the moſt diſtinguiſhed of the literati have even thought it of importance enough to turn the moſt celebrated maxims of morality, with the rules of civility, into verſe. Their poetry is ſeldom diſgraced by any kind of obſcenity; and indeed any ſuch thing would be ſeverely puniſhed by government. That ſevere attention with which every thing tending to corrupt the morals is watched in China, prohibits not only poems of this kind, but likewiſe romances of all ſorts. The police, however, permits ſuch novels as have an uſeful tendency, and in which nothing is introduced prejudicial to ſound morality. Every author who writes againſt government is puniſhed with death, as well as all thoſe who have had any hand in the printing or diſtribution of his works.

125 Chineſe paper. The art of making paper and printing have been long known among the Chineſe. That kind of paper now in uſe was firſt manufactured about 105 years before the Chriſtian æra. Before that period they uſed cloth, and various kinds of ſilk ſtuff, inſtead of paper; and to this day they ſtill preſerve a cuſtom of writing the praiſes of the dead upon large pieces of ſilk, which are ſuſpended on one ſide of the coffin, and carried in funeral proceſſions; and of ornamenting their apartments with maxims and moral ſentences written in the ſame manner. In ages ſtill more early, they wrote with a kind of ſtyle upon pieces of bamboo, or even upon plates of metal. The firſt paper was invented by a mandarin. He took the bark of trees, hemp, and old pieces of ſilk-ſtuff, boiling them together until they were reduced to a kind of paſte, of which he formed his paper; which by degrees was brought to perfection, and the art of whitening and giving it a luſtre found out. A great number of different ſubſtances are now uſed in this empire for making paper; ſuch as the bamboo, reed, the cotton ſhrub, the bark of the plant called *kou-chu*, and of the mulberry tree; hemp, the ſtraw of wheat and rice, parchment, the cods of the ſilk worm, and ſeveral other ſubſtances unknown in Europe. In this manufacture the bark of trees and ſhrubs is uſed, and the woody ſubſtance of the bamboo and cotton tree, after it has been macerated and reduced to a thin paſte. Moſt of the Chineſe paper, however, is attended with the diſadvantage of being very ſuſceptible of moiſture, readily attracts the duſt, and worms inſenſibly get into it: to prevent which inconveniences, it is neceſſary to beat the books often, and expoſe them to the ſun. That made of cotton is the pretteſt, and moſt uſed of any. All of them, however, are much ſofter and ſmoother than ours; which is abſolutely neceſſary for their method of writing with a pencil, in order that it may run with freedom, which it could not do upon ours. It is formed into ſheets of an enormous ſize; ſo that it would be no difficult matter to procure from the manufactories of this empire ſheets of paper 30 or 40 feet long.

126 Ink. The Chineſe ink came originally from Corea; and it was not until the year 900, that they hit upon the me-

thod of making it to perfection. The beſt is made in *Hoei-tcheou* in the province of *Kiangnan*; but its compoſition is a ſecret, which the workmen conceal not only from ſtrangers, but from their fellow-citizens. When a Chineſe has occaſion to write, he places upon his table a piece of poliſhed marble, having a cavity at one of its extremities to contain a little water. In this he dips the end of his cake of ink, and rubs it upon the ſmooth part of the marble; and as he preſſes more or leſs ſtrongly, the liquor acquires a deeper or lighter tinge of black. When he has done writing, the ſtone is carefully waſhed; for it would be diſhonoured by allowing the leaſt ſpot to remain. The pencils uſed in writing are commonly made of the fur of a rabbit, and conſequently very ſoft.

127 Their method of printing.

The Chineſe method of printing is exceedingly different from ours; and indeed it would be in a manner impoſſible to have moveable types for ſuch a number of characters as their language requires. The whole work which they intend to print is therefore engraved upon blocks of wood; and their method of proceeding is as follows. They firſt employ an excellent writer, who tranſcribes the whole upon very thin paper. The engraver glues each of the leaves of the manuſcript upon a piece of plank made of any hard wood; he then traces over with a graver the ſtrokes of the writing, carves out the characters in relief, and cuts down the intermediate part of the wood. Thus each page of a book requires a ſeparate plank; and the exceſſive multiplication of theſe is no doubt a very great inconvenience, one chamber being ſcarce ſufficient to preſerve thoſe employed for a ſingle book. The advantages are, that the work is thus free from typographical errors, and the author has no occaſion to correct the proofs. Thus alſo the bookſellers in China have a decided advantage over thoſe of Europe, as they are able by this method of printing to throw off copies according to their ſale, without running the riſk of being ruined by too large an addition. In this method the beauty of the work depends entirely upon the ſkill of the writer previouſly employed. The engravers are exceedingly dexterous, and imitate every ſtroke ſo exactly, that it is ſometimes difficult to diſtinguiſh a printed work from one that is only written.

The method of printing in China is not by a preſs as in Europe, as neither their wooden planks nor their ſoft paper could ſuſtain ſo much preſſure. They firſt place the plank level, and then fix it in that poſition. The printer is provided with two bruſhes, and, with the hardeſt, daubs the plank with ink; and one daubing is ſufficient for four or five leaves. After a leaf has been adjuſted upon the plank, the workman takes the ſecond bruſh, which is ſofter than the former, and of an oblong figure, and draws it gently over the paper, preſſing it down a little, that it may receive the ink. The degree of preſſure is to be regulated by the quantity of ink upon the plank: and in this manner one man is able to throw off almoſt 10,000 copies a-day. The ink uſed for printing is different from that formerly deſcribed, and which is uſed in writing. The leaves, on account of the thinneſs of the paper, are printed only upon one ſide; on which account each leaf of a book is double, ſo that the fold ſtands uppermoſt, and the opening is towards the back, where it is ſtitched. Hence the Chineſe books are not cut on the edges, but on the back. They are generally bound in grey paſteboard, which is very neat; and thoſe who wiſh to have them more elegantly done, get the paſteboard covered with ſatin, flowered taffety, and ſometimes with gold and ſilver brocade. Their books are neither gilt nor coloured on the edges like ours.

128 Vaſt quantity of ſilk produced.

The art of manufacturing ſilk, according to the beſt authorities, was communicated by the Chineſe to the Perſians, and from them to the Greeks. The art has been known in this empire from the remoteſt antiquity; and the breeding of ſilk-worms and making of ſilk was one of the employments even of the empreſſes in very early ages.

The moſt beautiful ſilk in the whole empire is that of *Tche-kiang*, which is wrought by the manufactories of Nankin. From theſe are brought all the ſtuffs uſed by the emperor, and ſuch as he diſtributes in preſents to his nobility. A great number of excellent workmen are alſo drawn to the manufactories of Canton by the commerce with Europe and other parts of Aſia. Here are manufactured ribbons ſtockings, and buttons. A pair of ſilk ſtockings here coſt little more than 6s. ſterling.

The quantity of ſilk produced in China ſeems to be almoſt inexhauſtible; the internal conſumption alone being incredibly great, beſides that which is exported in the commerce with Europe and the reſt of Aſia. In this empire all who poſſeſs a moderate fortune wear ſilk clothes; none but the lower claſs of people wearing cotton ſtuffs, which are commonly dyed blue. The principal ſtuffs manufactured by them are plain and flowered gauzes, of which they make ſummer dreſſes, damaſk of all colours; ſtripped and black ſatins; napped, flowered, ſtriped, clouded, and pinked taffeties; crapes, brocades, pluſh, different kinds of velvet, and a multitude of other ſtuffs unknown in Europe. They make particular uſe of two kinds; one named *touan-tſe*, a kind of ſatin much ſtronger, but, which has leſs luſtre, than that of Europe; the other a kind of taffety, of which they make drawers and linings. It is woven exceedingly cloſe, and is yet ſo pliable that it may be rumpled and rubbed between the hands without any creaſe; and even when waſhed like cotton-cloth, it loſes very little of its luſtre. They manufacture alſo a kind of gold brocades, but of ſuch a ſlight nature, that they cannot be worn in clothes: they are fabricated by wrapping fine ſlips of gilt paper round the threads of ſilk.

129 Porcelain

Porcelain is another great branch of Chineſe manufacture, and employs a vaſt number of workmen. The fineſt is made in a village called *King-te-ching* in the province of *Kiang-ſi*. Manufactories have alſo been erected in the provinces of Fo-kien and Canton, but their produce is not eſteemed, and one which the emperor cauſed to be erected at Peking, in order to be under his own inſpection, miſcarried entirely.

The Chineſe divide their porcelain into ſeveral claſſes, according to its different degrees of fineneſs and beauty. The whole of the firſt is reſerved for the uſe of the emperor, ſo that none of it ever comes into the hands of other perſons, unleſs it happen to be cracked or otherwiſe damaged in ſuch a manner as to be unworthy of being preſented to the ſovereign. Among that ſent to the emperor, however, there is ſome porcelain of an inferior quality, which he diſpoſes of in preſents. There is ſome doubt, therefore, whether any of the fineſt Chineſe porcelain was ever ſeen in Europe. Some value, however, is now put upon the European porcelain by the Chineſe themſelves.

130 Glaſs of little eſtimation.

The uſe of glaſs is very ancient in China, though it does not appear that great value was ever put upon this kind of ware, the art of manufacturing it having been frequently loſt and revived again in this empire. They greatly admire the workmanſhip of the European cryſtal, but prefer their own porcelain, which ſtands hot liquors, and is much leſs liable to be broken. The little eſtimation in which this ſubſtance was held, is even mentioned by their own writers in ſpeaking of the falſe pearls, mirrors and other toys which were made in former ages. The remembrance of a very large glaſs veſſel, however, which was made in 627, is ſtill preſerved; and of which it was ſaid that a mule could as eaſily enter it as a gnat could enter a pitcher. In order to tranſport this monſtrous veſſel from the place where it was manufactured to the emperor's palace, it was neceſſary to incloſe it in a net, the four corners of which were fixed to four carriages. The ſame indifference with regard to glaſs is ſtill entertained by the preſent emperors; however, a glaſs-houſe is eſtabliſhed at Peking, where a number of vaſes and other works are made; and theſe are ſo much the more difficult in the execution, as none of them are blown. This manufactory, as well as many others, is conſidered only as an appendage of the court, deſtined for the purpoſes of pomp and magnificence.

131 Medicine.

Moſt of the Chineſe medicine is abſolute quackery; their ſkill in anatomy is not only very limited, but mixed with ſuch a number of falſehoods, as render it in a manner abſolutely uſeleſs. Their materia medica conſiſts moſtly of herbs, of which tea is one. To this they aſcribe great and wonderful virtues, eſpecially if it has been gathered on any of the ſummits of a mountain called *Mong-chan*.

132 Method of diſcovering if a man has died a voluntary death.

The only thing regarding this ſcience, which merits any attention, is the method they are ſaid to poſſeſs of diſcovering whether a man has hanged or drowned himſelf, or had that violence committed upon him by others. In order to diſcover this, the body is firſt taken from the earth, and waſhed in vinegar. After this a large fire is kindled in a pit dug on purpoſe, ſix feet long, three wide, and the ſame depth. This fire is continually augmented, until the ſurrounding earth becomes as hot as an oven; the remaining fire is then taken out, a large quantity of wine is poured into it, and it is covered with a hurdle made of oſier twigs, upon which the body is ſtretched out at full length. A cloth is thrown over both in the form of an arch, in order that the ſteam of the wine may act upon it in every direction. At the end of two hours the cloth is taken off; and if any blows have been given, they then appear upon the body in whatever ſtate it may be. The Chineſe likewiſe aſſert, that if the blows given have been ſo ſevere as to occaſion death, this trial makes the marks appear upon the bones, though none of them ſhould be broken or apparently injured. The wine uſed in theſe trials is only a kind of beer made from rice and honey.

133 Of their muſic.

With regard to the muſic of the Chineſe, we have the ſame ſtories related as of the Greeks and Egyptians, viz. that in former ages the muſicians could make brute animals leap at the ſound of their inſtruments. Our author, M. Groſier, indeed, does not quote any Chineſe author who aſſerts that the ancient muſic could make trees dance, or ſtones arrange themſelves into a city; but he quotes them, aſſerting, "that the muſicians could call down ſuperior ſpirits of every age from the etherial regions; raiſe up the manes of departed beings; inſpire men with a love of virtue; and lead them to the practice of their duty." Effects of this ſupernatural kind are attributed to the ſacred muſic by the inſpired writers; as in the caſe of Saul, out of whom an evil ſpirit departed at the ſound of David's harp; and of Eliſha, who was inſpired with the ſpirit of prophecy at the ſound of a muſical inſtrument. It is probable therefore, that the relations both of the Greeks and Chineſe are founded upon facts of this kind; and we cannot from thence infer, that the muſic of early ages was at all ſuperior to that which followed. According to thoſe who have employed much time in theſe reſearches, the ancient Chineſe were acquainted with the diviſion of the octave into twelve ſemitones; and that before the time of Pythagoras, or even Mercury himſelf; that the lyre of Pythagoras, his invention of the diatonic tetrachords, and the formation of his grand ſyſtem, were merely borrowed from the ancient Chineſe. In ſhort, it is maintained, that the Greeks, even Pythagoras himſelf, did nothing but apply to ſtrings that theory which the Chineſe had before formed, and applied to pipes.

At preſent the Chineſe are not acquainted with the uſe of our muſical notes; they have not that diverſity of ſigns which diſtinguiſh the different tones, and the gradual elevation or depreſſion of the voice, nor any thing to point out the various modifications of ſound to produce harmony. They have only a few characters to mark the principal notes; and all the airs they learn are repeated merely by rote. The emperor Kang-hi was therefore greatly aſtoniſhed at the facility with which an European could catch and remember an air the firſt time he heard it. In 1679 he ſent for Fathers Grimaldi and Pereira, to play ſome tunes on the harpſichord, of which they had before made him a preſent. He was greatly entertained with their muſic, but altogether aſtoniſhed when he found that F. Pereira could take down a Chineſe air while the muſicians were playing it, and then repeat the whole without omitting a ſingle note. Having made ſeveral trials of this kind in order to ſatisfy himſelf, he beſtowed the higheſt encomiums upon the European muſic, and the means furniſhed by it to facilitate and leſſen the labour of the memory. "I muſt confeſs (ſays he) that the European muſic is incomparable, and that the like of this F. Pereiri is not to be found in my whole kingdom."

134 Muſical inſtruments.

The Chineſe have always diſtinguiſhed eight different ſounds; and they believe that nature, in order to produce theſe, formed eight different kinds of ſonorous bodies. The order in which they diſtribute theſe ſounds, and the inſtruments they have contrived to produce them, are, 1. The ſound of ſkin produced by drums. 2. That of ſtone produced by the *king*. 3. The ſound of metal by bells. 4. That of baked earth by the *huien*. 5. Of ſilk by the *kin* and *che*. 6. Of wood by the *yu*, and *tchou*. 7. Of the bamboo by the *koan*, and different flutes. 8. That of a gourd by the *cheng*.

The drums were originally compoſed of a box made of baked earth, and covered at the extremities with the ſkin of ſome animal; but on account of the brittleneſs of baked earth, wood was ſoon ſubſtituted in its ſtead. Greater part of theſe inſtruments are ſhaped like our barrels, but ſome are cylindric.

The inſtruments formed of the ſonorous ſtones are called *king*, diſtinguiſhed into *tſe-king* and *pien-king*. The *tſe-king* conſiſts only of one ſtone, and therefore produces only one note. The *pien-king* conſiſts of 16 ſtones ſuſpended together, and thus forming an inſtrument capable of producing all the tones admitted into the muſic of the ancient Chineſe. They are cut into the form of a carpenter's ſquare; their tone is flattened by diminiſhing their thickneſs, and is made ſharper by abridging their length.

135
Bells of immenſe ſize.

The bells in China have always been made of a mixture of tin and copper. They are of different ſhapes, and thoſe of the ancients were not round, but flatted, and in the lower part reſembling a creſcent. An inſtrument, correſponding to the *king* already mentioned, is compoſed of 16 bells of different ſizes. Some of their bells uſed on public occaſions are of enormous magnitudes. One at Peking is deſcribed as 13½ feet in diameter, 12½ in height, and 42 in circumference; the weight being upwards of 120,000 pounds. It is uſed for announcing the hours or watches of the night; and its ſound, which is prodigiouſly loud and ſtrong, has a moſt awful effect in the nighttime, by reverberating round the walls and the echo of the ſurrounding country. There are ſeveral others likewiſe of a vaſt ſize in the ſame city; one of which deſerves greatly to be admired on account of the beautiful characters with which it is covered: and which are as neat and perfect as if traced out by the hand of the fineſt writer, or formed by means of a ſtamp upon wax. F. le Comte tells us, that in all the cities of China there are bells for marking the hours and watches of the night. They generally divide the night into five watches, beginning at ſeven or eight in the evening. On the commencement of the firſt they give one ſtroke, which is repeated a moment after; and thus they continue for two hours till the beginning of the ſecond: they then give two ſtrokes, which are repeated at equal intervals till the beginning of the third watch; and thus they proceed to the fourth and fifth, always increaſing the number of the ſtrokes. For the ſame purpoſe alſo they uſe enormous drums, which they beat in a ſimilar manner. F. Magaillans mentions one at Peking upwards of 40 feet in circumference.

The inſtrument called *huien*, which is made of baked earth is highly eſteemed by the Chineſe on account of its antiquity. It is diſtinguiſhed into two kinds, the great and ſmall; the former being of the ſize of a gooſe's egg; the latter of that of a hen's. It has ſix holes, and a ſeventh for the mouth.

The *kin* and *tche* have been known from the remoteſt antiquity. The kin has ſeven ſtrings made of ſilk, and is diſtinguiſhed into three kinds, differing only in ſize. The body is formed of a kind of wood varniſhed black, and its whole length about five feet five inches. The *che* is about nine feet in length, has 25 ſtrings, and is divided into 25 kinds. F. Amiot aſſures us, that we have no inſtrument in Europe which deſerves to be preferred to it.

The inſtruments which emit the ſound of wood are the *tchou*, the *yu*, and the *tchoung-tou*. The firſt is ſhaped like a buſhel, and is beat on the inſide with a hammer; the ſecond, which repreſents a tyger ſquatting, is made to ſound by ſcraping its back gently with a rod; the third is a collection of twelve pieces of boards tied together, which are uſed for beating time, by holding them in the right hand, and knocking them gently againſt the palm of the left.

Many inſtruments are conſtructed of the bamboo. Theſe conſiſt of pipes joined together, or ſeparate, and pierced with more or fewer holes. The principal of all theſe wind inſtruments is the *cheng*, which emits the ſound of a gourd. This is formed by cutting off the neck of a gourd, and reſerving only the lower part. To this a cover is fitted, having as many holes as are equal to the number of ſounds required. In each of theſe holes a pipe made of bamboo is fixed, and ſhorter or longer according to the tone intended. The mouth of the inſtrument is formed of another pipe ſhaped like the neck of a gooſe; which is fixed to the gourd on one ſide, and ſerves to convey the air to all the pipes it contains. The ancient *cheng* varied in the number of their pipes, thoſe uſed at preſent have only 13.

136
Chineſe painting.

The painting of the Chineſe is undoubtedly inferior to that of the Europeans, though we are not by any means to judge of the abilities of the painters of this empire by the performances which are brought to Europe. M. Groſier remarks, that the works of the eminent Chineſe painters are never brought to Canton, becauſe they cannot find purchaſers among the European merchants. The latter delight only in obſcene pictures, which are not permitted by government, nor indeed will any artiſt of character execute them, though they prevail upon ſome of the inferior daubers to gratify them in this reſpect. It ſeems, however, to be univerſally agreed, that the Chineſe have no notion of correctneſs or perſpective, and little knowledge of the proportions of the human body, though it cannot be denied that they excel in painting flowers and animals. In theſe they pride themſelves in a ſcrupulouſly exact imitation of nature, inſomuch that it is no uncommon thing to hear a painter aſk his pupil how many ſcales there are between the head and tail of a carp.

Painting was formerly much eſteemed in China, but has now fallen into diſrepute on account of its political inutility. The cabinets and galleries of the emperor, however, are filled with European paintings, and the celebrated artiſts Caſtiglioni and Attiret were both employed; but their offer of erecting a ſchool of painting was rejected, leſt they ſhould by this means revive the taſte for that art which it had been formerly though prudent to ſuppreſs.

Painting in freſco was known in China long before the Chriſtian aera; and, like the Grecians, the Chineſe boaſt much of their celebrated painters of antiquity. Thus we are told of a door painted by Fan-hien, which was ſo perfect an imitation, that the people who entered the temple where it was attempted to go out by it, unleſs prevented by thoſe who had ſeen it before.

The preſent emperor has in his park an European village painted in freſco, which produces the moſt agreeable deception. The remaining part of the wall repreſents a landſcape and little hills, which are ſo happily blended with the diſtant mountains, that nothing can be conceived more agreeable. This was the production of Chineſe painters, and executed from deſigns ſketched out for them.

137 Engraving. Engraving in three, four, or five colours, is very ancient among the Chineſe, and was known in this empire long before its diſcovery in Europe.

138 Sculpture. Sculpture is very little known in this empire; nor is there a ſingle ſtatue in any of the ſquares or public edifices of Peking, not even in the emperor's palace. The only real ſtatues to be met with in the empire are thoſe which, for the ſake of ceremonious diſtinction, are uſed to ornament the avenues leading to the tombs of princes and men of great rank; or thoſe that are placed near the emperor's coffin, and that of his ſons and daughters in the interior part of the vault, where their remains are depoſited.

139 Architecture. The Chineſe architecture is entirely different from that of the Greeks or Romans: but nevertheleſs has certain proportions of its own, and a beauty peculiar to itſelf. The habitations of the emperor are real palaces, and announce in a ſtriking manner the majeſty and grandeur of the maſter who inhabits them. All the miſſionaries who had acceſs to the inſide of the emperor's palace at Peking, agreed, that if each of its parts, taken ſeparately, does not afford ſo much delight to the eye as ſome pieces of the grand architecture of Europe, the whole preſents a ſight ſuperior to any thing they had ever ſeen before. In the Chineſe architecture, when a pillar is two feet diameter at the baſe, its height muſt be 14 feet: and by meaſures of this kind the height of every building is determined.

Almoſt all the houſes and buildings in China are conſtructed of wood. One reaſon of this may be the dread of earthquakes; but, beſides this, ſuch buildings are rendered eligible by the heat and dampneſs of the ſouthern provinces, and the exceſſive cold in the northern, which would render ſtone houſes almoſt uninhabitable. Even at Peking, where the rains are but of ſhort duration, it is found neceſſary to cover the ſmall marble ſtair-caſes belonging to the imperial palace with pieces of felt: the humidity of the air moiſtens and ſoaks into every thing. During winter the cold is ſo exceedingly ſevere, that no window can be opened to the north, and water continues conſtantly frozen to the depth of a foot and a half for more than three months. For the ſame reaſons a variety of ſtories are not uſed in the Chineſe buildings; as neither a ſecond nor third ſtory would be habitable during the great heats of ſummer or the rigorous cold of winter. Though Peking is ſituated in the northern part of the empire, the heat there, during the dog-days, is ſo intolerably ſcorching, that the police obliges tradeſmen and ſhopkeepers to ſleep in the open air in the piazzas of their houſes, leſt they ſhould be ſtifled by retiring into their inner apartments. The habitations of people of rank, or of thoſe of eaſy circumſtances, generally conſiſt of five large courts, incloſed with buildings on every ſide. The method of building with ſeveral ſtories was, however, followed for ſeveral centuries, when the court reſided in the ſouthern provinces; and the taſte for this kind of building was carried to ſuch an height, that immenſe edifices were erected from 150 to 200 feet in height, and the pavilions or towers at the extremities roſe upwards of 300 feet. This kind of building, however, at length became diſguſting; though, either to preſerve the remembrance of it, or for the ſake of variety, there are ſtill ſome buildings to be ſeen ſeveral ſtories high in the palaces belonging to the emperor.

140 Bridges. A multiplicity of bridges are rendered neceſſary in China by the vaſt number of canals and rivers which interſect the empire. Anciently, however, the Chineſe bridges were much more ingenious as well as magnificent than they are at preſent. Some of them were ſo contrived that they could be erected in one day to ſupply the place of others which might happen to be broken down, or for other purpoſes. At that time they had bridges which derived their name from their figure; as *reſembling the rainbow; draw-bridges, bridges to move with pullies, compaſs-bridge*, &c. with many others entirely unknown at preſent. The building of bridges indeed was once a luxurious folly of the emperors; ſo that they were multiplied from whim or caprice, without any neceſſity, and without uſe. Still, however, many of them are extremely beautiful and magnificent. The arches of ſome are very lofty and acute, with eaſy ſtairs on each ſide, the ſteps of which are not quite three inches in thickneſs, for the greater facility of aſcending and deſcending: others have no arches, but are compoſed of large ſtones, ſometimes 18 feet in length, placed tranſverſely upon piles like planks. Some of theſe bridges are conſtructed of ſtone, marble, or brick; others of wood; and ſome are formed of a certain number of barks joined together by very ſtrong iron chains. Theſe are known by the name of floating bridges, and ſeveral of them are to be ſeen on the large rivers Kiang and Hoang-ho.

141 Ship-building. For ſeveral centuries the Chineſe have made no progreſs in ſhip-building. Their veſſels have neither mizen, bowſprit, nor top maſt. They have only a main and fore-maſt, to which is ſometimes added a ſmall top gallant-maſt. The main-maſt is placed almoſt in the ſame part of the deck as ours; but the fore-maſt ſtands much farther forward. The latter is to the former in the proportion of two to three; and the main-maſt is generally two-thirds of the length of the veſſel. They uſe mats for ſails, ſtrengthening them with whole bamboos equal in length to the breadth of the ſail, and extended acroſs it at the diſtance of a foot from one another. Two pieces of wood are fixed to the top and bottom of the ſail; the upper ſerves as a ſail-yard; and the lower, which is about five or ſix inches in thickneſs, keeps the ſail ſtretched when it is neceſſary to hoiſt or lower it. This kind of ſail may be folded or unfolded like a ſcreen. For caulking their veſſels they do not uſe pitch, but a particular kind of gum mixed with lime, which forms a compoſition of ſuch excellent quality, that one or two wells in the hold are ſufficient to keep the veſſel dry. They have not yet adopted the uſe of pumps, and therefore draw up the water with buckets. Their anchors are made of the hard wood called *iron-wood*, which they ſay is much

ſuperior to the metal, becauſe the latter ſometimes bend, but the former never do.

The Chineſe pretend to have been the firſt inventors of the mariner's compaſs, but ſeem to have little inclination to improve ſuch an important machine: however, they are well acquainted with the art of manœuvring a veſſel, and make excellent coaſting pilots, though they are bad ſailors in an open ſea.

China-Root, in the materia medica, the root of a ſpecies of Smilax, brought both from the Eaſt and Weſt Indies; and thence diſtinguiſhed into oriental and occidental. Both ſorts are longiſh, full of joints, of a pale-reddiſh colour, with no ſmell, and very little taſte. The oriental, which is the moſt eſteemed, is conſiderably harder and paler-coloured than the other. Such ſhould be choſen as is freſh, cloſe, heavy, and upon being chewed appears full of a fat unctuous juice. It is generally ſuppoſed to promote inſenſible perſpiration and the urinary diſcharge, and by its unctuous quality to obtund acrimonious juices. China-root was firſt brought into Europe in the year 1535, and uſed as a ſpecific againſt venereal and cutaneous diſorders. With this view it was made uſe of for ſome time; but has long ſince given place to more powerful medicines.

China-Ware. See Porcelain.

CHINCA, a ſea-port town of Peru in South America, ſituated in an extenſive valley of the ſame name, in W. Long. 76. 0. S. Lat. 13. 0.

CHINCOUGH, a convulſive kind of cough to which children are generally ſubject. See Medicine-*Index*.

CHINESE, in general denotes any thing belonging to China, or its inhabitants.

Chinese Swanpan. See Swanpan.

CHINKAPIN. See Fagus.

CHINNOR, a muſical inſtrument among the Hebrews, conſiſting of 32 chords. Kircher has given a figure of it, which is copied on Plate CXXXV.

CHINON, an ancient town of Tourain in France, remarkable for the death of Henry II. king of England, and for the birth of the famous Rabelais. It is ſeated on the river Vienne, in a fertile and pleaſant country, in E. Long. 0. 18. N. Lat. 47. 2.

CHIO, or Chios, an Aſiatic iſland lying near the coaſt of Natolia, oppoſite to the peninſula of Ionia. It was known to the ancients by the name of Æthalia, Macris, Pithyuſa, &c. as well as that of Chios. According to Herodotus, the iſland of Chios was peopled originally from Ionia. It was at firſt governed by kings; but afterwards the government aſſumed a republican form, which by the direction of Iſocrates was modelled after that of Athens. They were, however, ſoon enſlaved by tyrants, and afterwards conquered by Cyrus king of Perſia. They joined the other Grecians in the Ionian revolt; but were ſhamefully abandoned by the Samians, Leſbians, and others of their allies; ſo that they were again reduced under the yoke of the Perſians, who treated them with the utmoſt ſeverity. They continued ſubject to them till the battle of Mycale, when they were reſtored to their ancient liberty: this they enjoyed till the downfal of the Perſian empire, when they became ſubject to the Macedonian princes. In the time of the emperor Veſpaſian the iſland was reduced to the form of a Roman province; but the inhabitants were allowed to live according to their own laws under the ſuperintendance of a praetor. It is now ſubject to the Turks, and is called *Scio*. See that article.

CHIOCOCCA, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatae*. The corolla is funnel-ſhaped and equal; the berry unilocular, diſpermous, inferior.

CHIONANTHUS, the Snow-drop or Fringe tree: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 44th order, *Sepiariae*. The corolla is quadrifid, with the ſegments very long; the fruit is a plum. There is but one ſpecies particularly deſcribed by botaniſts, viz. the *Virginica*. It is common in Virginia and South Carolina, where it grows by the ſides of rivulets. It riſes to the height of ten feet; the leaves are as large as thoſe of the laurel, but much thinner. The flowers come out in May, and are of a pure white; from whence it has the name of the *ſnow-drop tree*. They hang down in large branches, and are cut into narrow ſegments; from which it has got its other name of the *fringe-tree*. After the flowers are fallen off, the fruit appears, which grows to the ſize of a ſloe, having a ſtone in the middle. The plants are propagated, in Britain, from ſeeds ſown on a hot-bed, and kept in a ſtove. Some have been raiſed from layers; but this method is very precarious, and therefore the other is to be preferred. The ſeeds are procured from America, for they never come to perfection in Britain.

CHIONE, in fabulous hiſtory, was daughter of Daedalion, of whom Apollo and Mercury became enamoured. To enjoy her company, Mercury lulled her to ſleep with his caduceus; and Apollo, in the night, under the form of an old woman, obtained the ſame favours as Mercury. From this embrace Chione became mother of Philammon and Autolycus; the former of whom, as being ſon of Apollo, became an excellent muſician; and the latter was equally notorious for his robberies, of which his father Mercury was the patron. Chione grew ſo proud of her commerce with the gods, that ſhe even preferred her beauty to that of Juno; for which impiety ſhe was killed by the goddeſs and changed into a hawk.——Another of the ſame name was daughter of Boreas and Orithyia, who had Eumolphus by Neptune. She threw her ſon into the ſea; but he was preſerved by his father.

CHIOS. See Chio and Scio.

CHIOURLIC, an ancient town of Turkey in Europe, and in Romania, with a ſee of a Greek biſhop. It is ſeated on a river of the ſame name, in E. Long. 7. 47. N. Lat. 41. 18.

CHIOZZO, an ancient and handſome town of Italy, in the territory of Venice, and in a ſmall iſland, near the Lagunes, with a podeſta, a biſhop's ſee, and a harbour defended by a fort. E. Long. 12. 23. N. Lat. 45. 17.

CHIPPENHAM, a town of Wiltſhire, ſeated on the river Avon. It is a good thoroughfare town; has a handſome ſtone-bridge over the river, conſiſting of 16 arches; and ſends two members to parliament.

There is here a manufacture of the beſt ſuperfine woollen cloth in England. W. Long. 2. 12. N. Lat. 51. 25.

CHIPPING, a phraſe uſed by the potters and china-men to expreſs that common accident both of our own ſtone and earthen ware, and the porcelain of China, the flying off of ſmall pieces, or breaking at the edges. Our earthen wares are particularly ſubject to this, and are always ſpoiled by it before any other flaw appears in them. Our ſtone-wares eſcape it better than theſe; but not ſo well as the porcelain of China, which is leſs ſubject to it than any other manufacture in the world. The method by which the Chineſe defend their ware from this accident, is this: They carefully burn ſome ſmall bamboo canes to a ſort of charcoal, which is very light, and very black; this they reduce to a fine powder, and then mix it into a thin paſte, with ſome of the varniſh which they uſe for their ware: they next take the veſſels when dried, and not yet baked, to the wheel; and turning them ſoftly round, they, with a pencil dipt in this paſte, cover the whole circumference with a thin coat of it; after this, the veſſel is again dried; and the border made with this paſte appears of a pale greyiſh colour when it is thoroughly dry. They work on it afterwards in the common way, covering both this edge and the reſt of the veſſel with the common varniſh. When the whole is baked on, the colour given by the aſhes diſappears, and the edges are as white as any other part; only when the baking has not been ſufficient, or the edges have not been covered with the ſecond varniſhing, we ſometimes find a duſky edge, as in ſome of the ordinary thick tea-cups. It may be a great advantage to the Engliſh manufactures to attempt ſomething of this kind. The willow is known to make a very light and black charcoal; but the elder, though a thing ſeldom uſed, greatly exceeds it. The young green ſhoots of this ſhrub, which are almoſt all pith, make the lighteſt and the blackeſt of all charcoal; this readily mixes with any liquid, and might be eaſily uſed in the ſame way that the Chineſe uſe the charcoal of the bamboo cane, which is a light hollow vegetable, more reſembling the elder ſhoots than any other Engliſh plant. It is no wonder that the fixed ſalt and oil contained in this charcoal ſhould be able to penetrate the yet raw edges of the ware, and to give them in the ſubſequent baking a ſomewhat different degree of vitrification from the other parts of the veſſel; which, though, if given to the whole, it might take off from the true ſemivitrified ſtate of that ware, yet at the edges is not to be regarded, and only ſerves to defend them from common accidents, and keep them entire. The Chineſe uſe two cautions in this application: the firſt in the preparation; the ſecond in the laying it on. They prepare the bamboo canes for burning into charcoal, by peeling off the rind. This might eaſily be done with the elder ſhoots, which are ſo ſucculent, that the bark ſtrips off with a touch. The Chineſe ſay, that if this is not done with their bamboo, the edges touched with the paſte will burſt in the baking: this does not ſeem indeed very probable; but the charcoal will certainly be lighter made from the peeled ſticks, and this is a known advantage. The other caution is, never to touch the veſſel with hands that have any greaſy or fatty ſubſtance about them; for if this is done, they always find the veſſel crack in that place.

CHIROGRAPH, was anciently a deed which, requiring a counterpart, was engroſſed twice on the ſame piece of parchment, counterwiſe; leaving a ſpace between, wherein was written CHIROGRAPH; through the middle whereof the parchment was cut, ſometimes ſtraight, ſometimes indentedly; and a moiety given to each of the parties. This was afterwards called *dividenda*, and *chartæ diviſæ*; and was the ſame with what we now call *charter-party*. See CHARTER-*Party*. The firſt uſe of theſe chirographs, in Britain, was in the time of Henry III.

CHIROGRAPH was alſo anciently uſed for a fine; and the manner of engroſſing the fines, and cutting the parchment in two pieces, is ſtill retained in England, in the office called the *chirographer's office*.

CHIROGRAPHER *of* FINES, an officer in the common pleas, in England, who engroſſes FINES acknowledged in that court into a perpetual record (after they have been examined, and paſſed by other officers), and writes and delivers the indentures thereof to the party. He makes two indentures; one for the buyer, the other for the ſeller; and a third indented piece, containing the effect of the fine, and called *the foot of the fine*; and delivers it to the *cuſtos brevium*.—The ſame officer alſo, or his deputy, proclaims all fines in court every term, and indorſes the proclamations on the backſide of the foot; keeping, withal, the writ of covenant, and the note of the fine.

CHIROMANCY, a ſpecies of divination drawn from the lines and lineaments of a perſon's hand; by which means, it is pretended, the diſpoſitions may be diſcovered. See DIVINATION, n° 9.

CHIRON, a famous perſonage of antiquity; ſtyled by Plutarch, in his dialogue on muſic, "*The wiſe Centaur.*" Sir Iſaac Newton places his birth in the firſt age after Deucalion's deluge, commonly called the *Golden Age*; and adds, that he formed the conſtellations for the uſe of the Argonauts, when he was 88 years old; for he was a practical aſtronomer, as well as his daughter Hippo: he may, therefore, be ſaid to have flouriſhed in the earlieſt ages of Greece, as he preceded the conqueſt of the Golden Fleece, and the Trojan war. He is generally called the ſon of Saturn and Phillyra; and is ſaid to have been born in Theſſaly among the CENTAURS, who were the firſt Greeks that had acquired the art of breaking and riding horſes: whence the poets, painters, and ſculptors, have repreſented them as a compound of man and horſe; and perhaps it was at firſt imagined by the Greeks, as well as the Americans, when they firſt ſaw cavalry, that the horſe and the rider conſtituted the ſame animal.

Burney's Hiſt. of Muſic.

Chiron was repreſented by the ancients as one of the firſt inventors of medicine, botany, and *chirurgery*; a word which ſome etymologiſts have derived from his name. He inhabited a grotto or cave in the foot of Mount Pelion, which, from his wiſdom and great knowledge of all kinds, became the moſt famous and frequented ſchool throughout Greece. Almoſt all the heroes of his time were fond of receiving his inſtructions; and Xenophon, who enumerates them, names the following illuſtrious perſonages among his diſciples: Cephalus, Æſculapius, Melanion, Neſtor, Amphiaraus,

phiaraus, Peleus, Telamon, Meleager, Theſeus, Hippolitus, Palamedes, Ulyſſes, Mneſtheus, Diomedes, Caſtor and Pollux, Machaon and Podalirius, Antilochus, Æneas, and Achilles. From this catalogue it appears, that Chiron frequently inſtructed both fathers and ſons; and Xenophon has given a ſhort eulogium on each, which may be read in his works, and which redounds to the honour of the preceptor. The Greek hiſtorian, however, has omitted naming ſeveral of his ſcholars, ſuch as Bacchus, Phœnix, Cocytus, Aryſtæus, Jaſon, and his ſon Medeus, Ajax, and Proteſilaus. Of theſe we ſhall only take notice of ſuch as intereſt Chiron more particularly. It is pretended that the Grecian Bacchus was the favourite ſcholar of the Centaur; and that he learned of this maſter the revels, orgies, bacchanalia, and other ceremonies of his worſhip. According to Plutarch, it was likewiſe at the ſchool of Chiron that Hercules ſtudied muſic, medicine, and juſtice; though Diodorus Siculus tells us, that Linus was the muſic-maſter of this hero. But among all the heroes, who have been diſciples of this Centaur, no one reflected ſo much honour upon him as Achilles, whoſe renown he in ſome meaſure ſhared; and to whoſe education he in a particular manner attended, being his grandfather by the mother's ſide. Apollodorus tells us, that the ſtudy of muſic employed a conſiderable part of the time which he beſtowed upon his young pupil, as an incitement to virtuous actions, and a bridle to the impetuoſity of his temper. One of the beſt remains of antique painting now exiſting, is a picture upon this ſubject, dug out of the ruins of Herculaneum, in which Chiron is teaching the young Achilles to play on the lyre. The death of this philoſophic muſician was occaſioned, at an extreme old age, by an accidental wound in the knee with a poiſoned arrow, ſhot by his ſcholar Hercules, at another. He was placed after his death by Muſæus among the conſtellations, through reſpect for his virtues, and in gratitude for the great ſervices which he had rendered the people of Greece. Sir Iſaac Newton ſays*, in proof of the conſtellations being formed by Chiron and Muſæus for the uſe and honour of the Argonauts, that nothing later than the expedition was delineated on the ſphere; according to the ſame author, Chiron lived till after the Argonautic expedition, in which he had two grandſons. The ancients have not failed to attribute to him ſeveral writings; among which, according to Suidas, are *precepts*, υποθηκαι, in verſe, compoſed for the uſe of Achilles, and a medicinal treatiſe on the *diſeaſes incident to horſes* and other quadrupeds, ιππιατρικον; the lexicographer even pretends, that it is from this work the Centaur derived his name. Fabricius gives a liſt of the works attributed to Chiron, and diſcuſſes the claims which have been made for others to the ſame writings; and in vol. xiii. he gives him a diſtinguiſhed place in his catalogue of ancient phyſicians.

CHIRONIA, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 20th order, *Rotaceæ*. The corolla is wheel-ſhaped; the piſtil declining downwards; the ſtamina placed in the tube of the corolla; the antheræ in their laſt ſtage ſpiral; the ſeed-caſe bilocular. There are eight ſpecies, of which the *fruteſcens* is the moſt remarkable. It is a native of the cape of Good Hope. The root is fibrous, and ſpreads near the ſurface of the ground. The ſtalks are round, and inclining to be ligneous, but are of a very ſoft texture; theſe riſe from two to three feet high, ſending out ſeveral branches which grow erect, and are garniſhed with ſucculent leaves an inch or more in length, and about an eighth of an inch in breadth. At the end of each ſhoot the flowers are produced, which are tubulous, and ſpread open at the top; they are of a bright red colour; and when there are a large number of flowers open on the ſame plant, they make a fine appearance. The flowers are produced from June to autumn; and the ſeeds ripen in October. The plants are propagated by ſeeds, which muſt be ſown in pots filled with light ſandy earth, and plunged in a moderate hot-bed. In ſummer they may be inured to the open air; but muſt always be ſheltered in winter.

CHIRONOMY, in antiquity, the art of repreſenting any paſt tranſaction by the geſtures of the body, more eſpecially by the motions of the hands: this made a part of liberal education; it had the approbation of Socrates, and was ranked by Plato among the political virtues.

CHIROTONY, among eccleſiaſtical writers, denotes the impoſition of hands uſed in conferring prieſtly orders. However, it is proper to remark, that chirotony was a method of electing magiſtrates by holding up the hands.

CHIRURGEON, or SURGEON. See SURGEON.

CHIRURGERY. See SURGERY.

CHISLEY-LAND, in agriculture, a ſoil of a middle nature between ſandy and clayey land, with a large admixture of pebbles.

CHISON, KISON, or KISSON, (Judges iv. and v.), a river of Galilee; ſaid to riſe in mount Tabor, to run by the town of Naim, and to fall into the Mediterranean between mount Carmel and Ptolemais, 1 Kings xviii. 40.

CHISSEL, or CHISEL, an inſtrument much uſed in ſculpture, maſonry, joinery, carpentry, &c.

There are chiſſels of different kinds; though their chief difference lies in their different ſize and ſtrength, as being all made of ſteel well ſharpened and tempered: but they have different names, according to the different uſes to which they are applied.—The chiſſels uſed in carpentry and joinery are, 1. The former; which is uſed firſt of all before the paring-chiſſel, and juſt after the work is ſcribed. 2. The paring-chiſſel; which has a fine ſmooth edge, and is uſed to pare off or ſmooth the irregularities which the former makes. This is not ſtruck with a mallet as the former is, but is preſſed with the ſhoulder of the workman. 3. Skew-former: this is uſed for cleanſing acute angles with the point or corner of its narrow edge. 4. The mortiſe-chiſſel; which is narrow, but very thick and ſtrong, to endure hard blows, and it is cut to a very broad baſil. Its uſe is to cut deep ſquare holes in the wood for mortiſes. 5. The gouge, which is a chiſſel with a round edge; one ſide whereof ſerves to prepare the way for an augre, and the other to cut ſuch wood as is to be rounded, hollowed, &c. 6. Socket-chiſſels, which are chiefly uſed by carpenters, &c. have their ſhank made with a hollow ſocket at top, to receive a ſtrong wooden ſprig, fitted into it with a ſhoulder. Theſe chiſſels are diſtinguiſhed, according to the breadth of the blade, into half-inch chiſſels, three quarters of an inch chiſſels, &c. 7. Ripping-chiſſels; which is a ſocket-chiſſel of an inch broad, having a blunt edge, with no baſil to it. Its uſe is to rip or tear two pieces of wood aſunder, by forcing in the blunt edge between them.

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* Chronol. p. 151.

CHITON, in zoology, a genus of the order of vermes teſtaceæ. The name *chiton* is from χιτων, *Lorica*, a coat of mail. The ſhell is plated, and conſiſts of many parts lying upon each other tranſverſely: the inhabitant is a ſpecies of the DORIS. They are common on the ſhores of Scarborough, Aberdeen, and Lochbroom. See ſeveral ſpecies repreſented of their natural ſize on Plate CXXXVIII.

CHITTIM (anc. geog.), according to Le Clerc, Calmet, and others, was the ſame with Macedonia, peopled by Kittim the ſon of Javan and grandſon of Noah.

CHITTRICK's MEDICINE FOR THE STONE. This medicine was ſome years ago kept as a ſecret, and had great reputation as a lithontriptic, which indeed in many caſes it ſeems to deſerve. It was diſcovered by Dr Blackrie, to be no other than ſoap-lye; and the following receipt for uſing it was procured by General Dunbar: "Take one tea-ſpoonful of the ſtrongeſt ſoap-lye, mixed in two table-ſpoonfuls of ſweet milk, an hour before breakfaſt and at going to bed. Before you take the medicine, take a ſup of pure milk, and immediately after you have ſwallowed the medicine take another. If you find this agrees with you for two or three days, you may add half as much more to the doſe."

1
Definition.

CHIVALRY, (from *cheval*, "a horſe);" an abſtract term, uſed to expreſs the peculiar privileges, obligations, and turn of mind, with all the other diſtinguiſhing characteriſtics of that order of men who flouriſhed in Europe in the dark ages, during the vigour of the feudal ſyſtems of government, under the name of *Knights*, or *Knights Errant*.

2
Difficulty of tracing the origin of chivalry.

To aſcertain the period at which the order ſprung up, and the circumſtances to which its origin was owing, is no eaſy taſk. In the hiſtory of ſociety, ſuch a multiplicity of collateral facts appear interwoven together, and cauſes and effects run into each other by a gradation ſo imperceptible; that it is exceedingly difficult, even for the niceſt eye, to diſcern cauſes from their immediate effects, or to diſtinguiſh to which among a number of collateral circumſtances the origin of any particular event is to be referred. The age to which we muſt look for the origin of chivalry was ſingularly rude and illiterate. Even the principal events of that period, emigrations, wars, and the eſtabliſhment of ſyſtems of laws and forms of government, have been but imperfectly, and in many inſtances unfaithfully, recorded. But the tranſactions which took place in the ordinary courſe of civil and domeſtic life, and which, though leſs ſtriking, muſt have always prepared the way for the more remarkable events, have been generally thought unworthy of tranſmiſſion to poſterity, and have very ſeldom found an hiſtorian. Add to theſe difficulties which oppoſe our reſearches on this ſubject, that the nations of Europe were in that age a mixed multitude, conſiſting of the aboriginal inhabitants, who, though either ſubdued by the Roman arms, or at leaſt compelled to retire to the woods and mountains, ſtill obſtinately retained their primitive manners and cuſtoms; Roman colonies, and ſuch of the original inhabitants of the countries in which theſe were eſtabliſhed, as had yielded not only to the arms of the Romans, but alſo to the influence of their laws, arts, and manners; and the barbarians, who proceeding from the northern regions of Aſia and Europe, the wilds of Scythia and Germany, diſſolved the fabric of the Roman empire, and made themſelves lords of Europe. Amid this confuſion of nations, inſtitutions and cuſtoms, it becomes almoſt impoſſible to trace any regular ſeries of cauſes and effects.

Yet as the hiſtory of that period is not entirely unknown to us, and the obſcure and imperfect records in which it is preſerved, while they commemorate the more remarkable events, throw a faint light on the cuſtoms, manners, and ordinary tranſactions of the age; we can at leaſt collect ſome circumſtances, which, if they did not of themſelves give riſe to the inſtitution of chivalry, muſt certainly have co-operated with others to that end. We may even be allowed, if we proceed with due diffidence and caution, to deduce, from a conſideration of the effect, ſome inferences concerning the cauſe; from thoſe particulars of its hiſtory which are known to us, we may venture to carry imagination backwards, under a proper reſtraint, to thoſe, which are hid under the darkneſs of a rude and illiterate age.

3
Diſtinction of ranks an eſſential part of the mechaniſm of ſociety.

Diſtinction of ranks appear to be eſſentially neceſſary to the exiſtence of civil order. Even in the ſimpleſt and rudeſt ſocial eſtabliſhments, we find not merely the natural diſtinctions of weak and ſtrong, young and old, parent and child, huſband and wife; theſe are always accompanied with others which owe their inſtitution to the invention of man, and the conſent, either tacit or formal, of the ſociety among whom they prevail. In peace and in war, ſuch diſtinctions are equally neceſſary: they conſtitute an eſſential and important part of the mechaniſm of ſociety.

4
The early pre-eminence of the military character.

One of the earlieſt artificial diſtinctions introduced among mankind, is that which ſeparates the bold and ſkilful warrior from thoſe whoſe feebleneſs of body and mind renders them unable to excel in dexterity, ſtratagem, or valour. Among rude nations, who are but imperfectly acquainted with the advantages of ſocial order, this diſtinction is more remarkably eminent than in any other ſtate of ſociety. The ferocity of the human character in ſuch a period produces almoſt continual hoſtilities among neighbouring tribes: the elements of nature, and the brute inhabitants of the foreſt, are not yet reduced to be ſubſervient to the will of man; and theſe, with other concomitant circumſtance, render the warrior, who is equally diſtinguiſhed by cunning and valour, more uſeful and reſpectable than any other character.

5
Subordinate diſtinctions of rank introduced into ſociety.

On the ſame principles, as the boundaries of ſociety are enlarged, and its form becomes more complex, the claſſes into which it is already diſtinguiſhed are again ſubdivided. The invention of arts, and the acquiſition of property, are the chief cauſes of theſe new diſtinctions which now ariſe among the orders of ſociety;

and they extend their influence equally through the whole ſyſtem. Difference of armour, and different modes of military diſcipline, produce diſtinction of orders among thoſe who practiſe the arts of war; while other circumſtances, originating from the ſame general cauſes, occaſion ſimilar changes to take place amid the ſcenes of peace.

6
The diſtinction introduced into the military order by the uſe of cavalry.

None of the new diſtinctions which are introduced among men, with reſpect to the diſcipline and conduct of war, in conſequence of the acquiſition of property and the invention of arts, is more remarkable than that occaſioned by the uſe of horſes in military expeditions, and the training of them to the evolutions of the military art. Fire-arms, it is true, give to thoſe who are acquainted with them a greater ſuperiority over thoſe to whom their uſe is unknown than what the horſeman poſſeſſes over him who fights on foot. But the uſe of fire-arms is of ſuch importance in war, and the expence attending it ſo inconſiderable, that wherever theſe have been introduced, they have ſeldom been confined to one particular order in an army; and therefore they produce indeed a remarkable, though tranſient, diſtinction among different nations; but eſtabliſh no permanent diſtinctions in the armies of any one nation. But to maintain a horſe, to equip him with coſtly furniture, to manage him with dexterity and vigour, are circumſtances which have invariably produced a ſtanding and conſpicuous diſtinction among the military order, wherever bodies of cavalry have been formed. The Roman *equites*, who, though they became at length a body of uſurers and farmers-general, were originally the only body of cavalry employed by the ſtate, occupied a reſpectable rank between the ſenators and the plebeians; and the elegance and humanity of their manners were ſuitable to their rank. In ancient Greece, and in the celebrated monarchies of Aſia, the ſame diſtinction prevailed at a ſimilar period.

7
Military diſtinctions among the ancient Germans.

Since the circumſtances and principles on which this diſtinction depends are not ſuch as muſt be confined in their influence to one particular nation, or one region of the globe, we may hope to trace their effects among the ſavage warriors of Scythia and Germany, as well as among the Greeks or Romans. From the valuable treatiſe of Tacitus *de moribus Germanorum*, we learn, that among the German warriors a diſtinction ſomewhat of this nature *did* actually ſubſiſt; not ſo much indeed a diſtinction between the warrior who fought on horſeback and thoſe who fought on foot, as between thoſe whom vigour of body and energy of mind enabled to brave all the dangers of war, and ſuch as, from the imbecility of youth, the infirmities of age, or the natural inferiority of their mental and bodily powers, were unequal to ſcenes of hardſhip and deeds of valour. The youth was not permitted to take arms and join his warlike countrymen in their military expeditions whenever he himſelf thought proper. There was a certain age before which he could not be inveſted with armour. When he had attained that period, if not found deficient in ſtrength, activity, or courage, he was formally honoured with the ſhield and the lance, called to the duties, and admitted to all the privileges, of a warrior.

8
Reſpectability of the women among the Germans.

Another fact worthy of notice reſpecting the manners of the barbarians of Germany before they eſtabliſhed themſelves in the cultivated provinces of the Roman empire is, that their women, contrary to what we find among many other rude nations, were treated with an high degree of reſpect. They did not generally vie with the men in deeds of valour, but they animated them by their exhortations to diſtinguiſh themſelves in the field; and virgins eſpecially were conſidered with a ſacred veneration, as endowed with prophetic powers, capable to foreſee events hid in the womb of futurity, and even to influence the will of the deities. Hence, though domeſtic duties were their peculiar province, yet they were not harſhly treated nor confined to a ſtate of ſlavery. There appears indeed a ſtriking analogy between the condition of the women among the rude ſoldiers of Sparta and the rank which they occupied among the warlike cantons of Germany. Perhaps, indeed, the German were ſtill more honourable than the Spartan women; as they were taught to wield the magic weapons of ſuperſtition, which in Greece were appropriated to the prieſts.

It appears, therefore, that, in the foreſts of Germany at leaſt, if not in the more northern regions of Aſia and Europe, the conquerors of the Roman empire, before they penetrated into its provinces, treated their women with a degree of reſpect unknown to moſt of the nations of antiquity; that the character of the warrior was likewiſe highly honourable, being underſtood to unite all thoſe qualities which were in the higheſt eſtimation; and that it was only at a particular age, and with certain forms, that the youth were admitted to bear arms.

9
Changes in the manners of the barbarians after they ſettled in the Roman empire, which gave riſe to chivalry.

When thoſe nations ſallied from their deſerts and foreſts, over-ran the Roman empire, and eſtabliſhed themſelves in its provinces, the change which took place on their circumſtances was remarkable; and by a natural influence, it could not but produce an equally remarkable change on their habits, cuſtoms, and manners. The great outlines might ſtill remain; but they could not now fail to be filled up in a different manner. Here, however, the records of hiſtory are peculiarly imperfect. We have no Cæſar or Tacitus to ſupply facts or direct our reaſonings; the Gothic nations had not yet learned to read and write; and the Romans were ſo depreſſed under the ſenſe of their own miſeries, as to be negligent of the changes which happened around them. But as ſoon as the light of hiſtory begins again to dawn, we find that the leading features of the barbarian character were not effaced, but only modified in a particular manner, in conſequence of their mixing among a more poliſhed people, becoming acquainted with the luxuries of life, and acquiring extenſive power and property.

Thoſe who fought on horſeback now began to be diſtinguiſhed with peculiar honours. The manners of the warrior too were become more cultivated, and his ſpirit more humane. Leiſure and opulence, with the influence of a poliſhed people, even though in a ſtate of ſlavery, taught thoſe barbarians to aſpire after more refined pleaſures and more ſplendid amuſements than thoſe which they had been before ſatisfied with. The influence of chriſtianity too, which, though groſsly corrupted, was ſtill favourable to the ſocial happineſs of mankind, concurred to poliſh their manners and exalt their character. Hence, in the end of the tenth and in the beginning of the eleventh century, we ſee knight-errantry, with that romantic gallantry, piety, and humanity, by which it was principally diſtinguiſhed, make its appearance. At the court of every prince, count, or baron, jouſts and tournaments became the favourite amuſements. At thoſe entertainments, ſkill in arms, devotion to the fair, and generous courteſy, were all at once cultivated. About this period began the cruſades; and theſe, to which alone ſome have referred the origin of chivalry, though they could not give riſe to what was already in exiſtence, yet moulded the form and directed the ſpirit of the inſtitution in ſuch a manner, as to raiſe it, by a rapid progreſs from infancy, as it were, to full vigour and maturity. Its character, as it appeared when fully formed, is well deſcribed by an eloquent hiſtorian in the following manner:

Gibbon, vol. vi. p. 26.

"Between the age of Charlemagne and that of the cruſades, a revolution had taken place among the Spaniards, the Normans, and the French, which was gradually extended to the reſt of Europe. The ſervice of the infantry was degraded to the plebeians; the cavalry formed the ſtrength of the armies, and the honourable name of *miles*, or ſoldier, was confined to the gentlemen who ſerved on horſeback, and were inveſted with the character of knighthood. The dukes and counts, who had uſurped the rights of ſovereignty, divided the provinces among their faithful barons: the barons diſtributed among their vaſſals the fiefs or benefices of their juriſdiction; and theſe military tenants, the peers of each other and of their lord, compoſed the noble or equeſtrian order, which diſdained to conceive the peaſant or burgher as of the ſame ſpecies with themſelves. The dignity of their birth was preſerved by pure and equal alliances; their ſons alone who could produce four quarters or lines of anceſtry, without ſpot or reproach, might legally pretend to the honour of knighthood; but a valiant plebeian was ſometimes enriched and ennobled by the ſword, and became the father of a new race. A ſingle knight could impart, according to his judgment, the character which he received; and the warlike ſovereigns of Europe derived more glory from this perſonal diſtinction than from the luſtre of their diadem. This ceremony was in its origin ſimple and profane; the candidate, after ſome previous trial, was inveſted with his ſword and ſpurs; and his cheek and ſhoulder were touched with a ſlight blow as the emblem of the laſt affront which it was lawful for him to endure. But ſuperſtition mingled in every public and private action of life: In the holy wars, it ſanctified the profeſſion of arms; and the order of chivalry was aſſimilated in its rights and privileges to the ſacred orders of prieſthood. The bath and white garment of the novice, were an indecent copy of the regeneration of baptiſm: his ſword, which he offered on the altar, was bleſſed by the miniſters of religion; his ſolemn reception was preceded by faſts and vigils; and he was created a knight in the name of God, of St George, and of St Michael the archangel. He ſwore to accompliſh the duties of his profeſſion; and education, example, and the public opinion, were the inviolable guardians of his oath. As the champion of God and the ladies, he devoted himſelf to ſpeak the truth; to maintain the right; to protect the diſtreſſed; to practiſe *courteſy*, a virtue leſs familiar to the ancients; to purſue the infidels; to deſpiſe the allurements of eaſe and ſafety; and to vindicate in every perilous adventure the honour of his character. The abuſe of the ſame ſpirit provoked the illiterate knight to diſdain the arts of induſtry and peace; to eſteem himſelf the ſole judge and avenger of his own injuries; and proudly to neglect the laws of civil ſociety and military diſcipline. Yet the benefits of this inſtitution, to refine the temper of barbarians, and to infuſe ſome principles of faith, juſtice, and humanity, were ſtrongly felt, and have been often obſerved. The aſperity of national prejudice was ſoftened; and the community of religion and arms ſpread a ſimilar colour and generous emulation over the face of Chriſtendom. Abroad, in enterpriſe and pilgrimage; at home, in martial exerciſe, the warriors of every country were perpetually aſſociated; and impartial taſte muſt prefer a Gothic tournament to the Olympic games of claſſic antiquity. Inſtead of the naked ſpectacles which corrupted the manners of the Greeks, and baniſhed from the ſtadium the virgins and matrons, the pompous decoration of the liſts was crowned with the preſence of chaſte and high-born beauty, from whoſe hands the conqueror received the prize of his dexterity and courage. The ſkill and ſtrength that were exerted in wreſtling and boxing, bear a diſtant and doubtful relation to the merit of a ſoldier; but the tournaments, as they were invented in France, and eagerly adopted both in the eaſt and weſt, preſented a lively image of the buſineſs of the field. The ſingle combats, the general ſkirmiſh, the defence of a paſs or caſtle, were rehearſed as in actual ſervice; and the conteſt, both in real and mimic war, was decided by the ſuperior management of the horſe and lance. The lance was the proper and peculiar weapon of the knight: his horſe was of a large and heavy breed: but his charger, till he was rouſed by the approaching danger, was uſually led by an attendant, and he quietly rode a pad or palfrey of a more eaſy peace. His helmet and ſword, his greaves and buckler, it would be ſuperfluous to deſcribe; but I may remark, that at the period of the cruſades, the armour was leſs ponderous than in latter times; and that, inſtead of a maſſy cuiraſs, his breaſt was defended by an hauberk or coat of mail. When their long lances were fixed in the reſt, the warriors furiouſly ſpurred their horſes againſt the foe; and the light cavalry of the Turks and Arabs could ſeldom ſtand againſt the direct and impetuous weight of their charge. Each knight was attended to the field by his faithful ſquire, a youth of equal birth and ſimilar hopes; he was followed by his archers and men at arms; and four, or five, or ſix ſoldiers, were computed as the furniture of a complete *lance*. In the expeditions to the neighbouring kingdoms or the Holy Land, the duties of the feudal tenure no longer ſubſiſted; the voluntary ſervice of the knights and their followers was either prompted by zeal or attachment, or purchaſed with rewards and promiſes; and the numbers of each ſquadron were meaſured by the power, the wealth, and the fame of each independent chieftain. They were diſtinguiſhed by his banner, his armorial coat, and his cry of war; and the moſt ancient families of Europe muſt ſeek in theſe achievements the origin and proof of their nobility."

The reſpectable author of the Letters on Chivalry and Romance, traces, with great ingenuity and erudition, a ſtrong reſemblance between the manners of the age of chivalry and thoſe of the old heroic ages delineated by Homer.

10 The reſemblance between heroic and Gothic manners.

There is, ſays he, a remarkable correſpondence between the manners of the old heroic times, as painted by their great romancer Homer, and thoſe which are repreſented to us in the modern books of knight-errantry. A fact of which no good account can be given, but by another not leſs certain; that the political ſtates of Greece, in the earlieſt periods of its ſtory, was ſimilar in many reſpects to that of Europe, as broken by the feudal ſyſtem into an infinite number of petty independent governments.

Some obvious circumſtances of agreement between the heroic and Gothic manners may be worth putting down.

1. The military enthuſiaſm of the barons is but of a piece with the fanaticiſm of the heroes. Hence the ſame particularity of deſcription in the accounts of battles, wounds, deaths, in the Greek poet as in the Gothic romancers. Hence that minute curioſity in the diſplay of their dreſſes, arms, accoutrements. The minds of all men being occupied with warlike images and ideas, were much gratified by thoſe details, which appear cold and unaffecting to modern readers.

We hear much of knights-errant encountering giants and quelling ſavages in books of chivalry. Theſe giants were oppreſſive feudal lords; and every lord was to be met with, like the giant, in his ſtrong-hold or caſtle. Their dependents of a lower form, who imitated the violence of their ſuperiors, and had not their caſtles but lurking places, were the ſavages of romance. The greater lord was called a giant for his power; the leſs, a ſavage for his brutality.

2. Another terror of the Gothic ages was monſters, dragons, and ſerpents. Their ſtories were received in thoſe days for ſeveral reaſons: 1. From the vulgar belief of enchantments: 2. From their being reported on the faith of eaſtern tradition, by adventurers from the Holy Land: 3. In ſtill later times from the ſtrange things told and believed on the diſcovery of the new world.

In all theſe reſpects, Greek antiquity reſembles the Gothic. For what are Homer's Læſtrigon's and Cyclops, but bands of lawleſs ſavages, with each of them a giant of enormous ſize at their head? And what are the Grecian Bacchus, Hercules, and Theſeus, but knights-errant, the exact counterparts of Sir Launcelot and Amadis de Gaul?

3. The oppreſſion with which it was the glory of the knights to avenge, were frequently carried on, as we are told, by the *charms and enchantments of women*. Theſe charms, we may ſuppoſe, are often metaphorical; as expreſſing only the blandiſhments of the ſex. Sometimes they are taken to be real, the ignorance of thoſe ages acquieſcing in ſuch conceits. And are not theſe ſtories matched by thoſe of Calypſo and Circe, the enchantreſſes of the Greek poet?

4. Robbery and piracy were honourable in both: ſo far were they from reflecting any diſcredit on the ancient and modern *redreſſers of wrongs*. What account can be given of this, but that, in the feudal times, and in the early days of Greece, when government was weak, and unable to redreſs the injuries of petty ſovereigns, it would be glorious for private adventurers to undertake this work; and, if they could accompliſh it in no other way, to pay them in kind by downright plunder and rapine?

5. Baſtardy was in credit with both. They were extremely watchful over the chaſtity of their own women; but ſuch as they could ſeize upon in the enemies quarter, were lawful prize. Or if, at any time, they tranſgreſſed in this ſort at home, the fault was covered by an ingenious fiction. The offspring was reputed divine. Their greateſt heroes were the fruit of goddeſſes approached by mortals; juſt as we hear of the doughtieſt knights being born of fairies.

6. With the greateſt fierceneſs and ſavageneſs of character, the utmoſt generoſity, hoſpitality, and courteſy, were imputed to the heroic ages. Achilles was at once the moſt relentleſs, vindictive, implacable, and the friendlieſt of men. We have the very ſame repreſentation in the Gothic romances. As in thoſe lawleſs times, dangers and diſtreſſes of all kinds abounded, there would be the ſame demand for compaſſion, gentleneſs, and generous attachment to the unfortunate, thoſe eſpecially of their own clan, as of reſentment, rage, and animoſity againſt their enemies.

7. Again, the martial games celebrated in ancient Greece, on great and ſolemn occaſions, had the ſame origin and the ſame purpoſe as the tournaments of the Gothic warriors.

8. Laſtly, the paſſions for adventures ſo natural in their ſituation, would be as naturally attended with the love of praiſe and glory. Hence the ſame encouragement, in the old Greek and Gothic times, to panegyriſts and poets. In the affairs of religion and gallantry, indeed, the reſemblance between the hero and the knight is not ſo ſtriking. But the religious character of the knight was an accident of the times and no proper effect of his civil condition. And that his devotion for the fair ſex ſhould ſo far ſurpaſs that of the hero, is a confirmation of the ſyſtem here advanced. For the conſideration had of the females in the feudal conſtitution, will of itſelf account for this deference. It made them capable of ſucceeding to fiefs, as well as the men. And does not one ſee, on the inſtant, what reſpect and dependence this privilege would draw upon them?

It was of mighty conſequence who ſhould obtain the favour of a rich heireſs. And though, in the ſtrict feudal times, ſhe was ſuppoſed to be in the power and at the diſpoſal of her ſuperior lord, yet this rigid ſtate of things did not laſt long. Hence we find ſome diſtreſſed damſel was the ſpring and mover of every knight's adventure. She was to be reſcued by his arms, or won by the fame and admiration of his proweſs. The plain meaning of all which was this: That as, in theſe turbulent times, a protector was neceſſary to the weakneſs of the ſex, ſo the courteous and valorous knight was to approve himſelf qualified for that purpoſe.

It may be obſerved, that the two poems of Homer were intended to expoſe the miſchiefs and inconveniences ariſing from the political ſtate of Old Greece: the *Iliad*, the diſſentions that naturally ſpring up among independent chiefs; and the *Odyſſey* the inſolence of their greater ſubjects, more eſpecially when unreſtrained by the preſence of their ſovereign. And can any thing more exactly reſemble the condition of the feudal times, when, on occaſion of any great enterpriſe, as that of the cruſades, the deſigns of the confederate Chriſtian ſtates were perpetually fruſtrated, or interrupted at leaſt, by the diſſentions of their leaders; and their affairs at home, as perpetually diſtreſſed and diſordered by the rebellious uſurpations of their greater vaſſals? Jeruſalem was to the European what Troy had been to the Grecian princes. See the article KNIGHT.

CHIVALRY, in law, is uſed for a tenure of lands by knight's ſervice; whereby the knight was bound to perform ſervice in war unto the king, or the meſne lord of whom he held by that tenure. And chivalry was either general or ſpecial: *general*, when it was only in the feoffment that the tenant held *per ſervitium militare*, without any ſpecification of ſergeantry, eſcuage; &c.; *ſpecial*, when it was declared particularly by what kind of knight ſervice the land was held.

For the better underſtanding of this tenure it hath been obſerved, that there is no land but is holden mediately or immediately of the crown by ſome ſervice; and therefore all freeholds that are to us and our heirs, are called *feuda* or *feoda*, "fees;" as proceeding from the king for ſome ſmall yearly rent, and the performance of ſuch ſervices as were originally laid upon the land at the donation thereof. For as the king gave to the great nobles his immediate tenants, large poſſeſſions for ever, to hold of him for this or that ſervice or rent; ſo they in time parcelled out to ſuch others as they liked the ſame lands for rents and ſervices as they thought good: and theſe ſervices were by Littleton divided into two kinds, *chivalry* and *ſocage;* the firſt whereof was martial and military, the other ruſtical. Chivalry, therefore, was a tenure of ſervice, whereby the tenant was obliged to perform ſome noble or military office unto his lord: and it was of two kinds, either *regal*, that is, held only by the king; or *common*, where held of a common perſon. That which might be held only of the king was called *ſervitium*, or *ſergeantia;* and was again divided into *grand* and *petit* ſerjeanty. The grand ſerjeanty was where one held lands of the king by ſervice, which he ought to do in his own perſon; as to bear the king's banner or ſpear, to lead his hoſt, to find men at arms to fight, &c. Petit ſerjeanty was when a man held lands of the king, to yield him annually ſome ſmall thing towards his wars, as a ſword, dagger, bow, &c. Chivalry that might be holden of a common perſon was termed *ſcutagium*, "eſcuage;" that is, ſervice of the ſhield; which was either uncertain or certain.

Eſcuage uncertain, was likewiſe two-fold: firſt, where the tenant was bound to follow his lord, going in perſon to the king's wars, either himſelf, or ſending a ſufficient man in his place, there to be maintained at his expence, ſo long as was agreed upon between the lord and his firſt tenant at the granting of the fee; and the days of ſuch ſervice ſeem to have been rated by the quantity of land ſo holden: as if it extended to a whole knight's fee, then the tenant was to follow his lord 40 days; and if but to half a knight's fee, then 20 days; if a fourth part, then 10 days, &c. The other kind of this eſcuage was called *caſtle-ward*, where the tenant was obliged, by himſelf or ſome other, to defend a caſtle as often as it ſhould come to his turn. And theſe were called *eſcuage uncertain;* becauſe it was uncertain how often a man ſhould be called to follow his lord to the wars, or to defend a caſtle, and what his charge would be therein.

Eſcuage certain, was where the tenure was ſet at a certain ſum of money to be paid in lieu of ſuch ſervice; as that a man ſhould pay yearly for every knight's fee 20s. for half a knight's fee 10s. or ſome like rate; and this ſervice, becauſe it is drawn to a certain rent, groweth to be of a mixed nature, not merely ſocage, and yet ſocage in effect, being now neither perſonal ſervice nor uncertain. The tenure called chivalry had other conditions annexed to it: but there is a great alteration made in theſe things by the ſtat. 12. Car. 2. c. 24. whereby tenures by knight's ſervice of the king, or any other perſon *in capite*, &c. and the fruits and conſequences thereof, are taken away and diſcharged; and all tenures are to be conſtrued and adjudged to be free and common ſocage, &c.

Court of CHIVALRY, a court formerly held before the lord high conſtable and earl marſhal of England jointly, and having both civil and criminal juriſdiction: but ſince the attainder of Stafford Duke of Buckingham under Henry VIII. and the conſequent extinguiſhment of the office of lord high conſtable, it hath uſually, with reſpect to civil matters, been heard before the earl marſhal only. This court, by ſtat. 13. Rich. II. c. 2. hath cognizance of contracts and other matters touching deeds of arms and war, as well out of the realm as in it. And from its ſentences lies an immediate appeal to the king in perſon. This court was in great reputation in the times of pure chivalry; and afterwards during the Engliſh connections with the continent, by the territories which their princes held in France: but it is now grown almoſt entirely out of uſe, on account of the feebleneſs of its juriſdiction, and want of power to enforce its judgments; as it can neither fine nor impriſon, not being a court of record.

1. The *civil* juriſdiction of this court of chivalry is principally in two points; the redreſſing injuries of honour, and correcting encroachments in matters of coat armour, precedency, and other diſtinctions, of families. As a court of honour, it is to give ſatisfaction to all ſuch as are aggrieved in that point; a point of a nature ſo nice and delicate, that its wrongs and injuries eſcape the notice of the common law, and yet are fit to be redreſſed ſomewhere. Such, for inſtance, as calling a man a *coward*, or giving him the lie; for which, as they are productive of no immediate damage to his perſon or property, no action will lie in the courts at Weſtminſter: and yet they are ſuch injuries as will prompt every man of ſpirit to demand ſome honourable amends; which by the ancient law of the land, was given in the court of chivalry. But modern reſolutions have determined, that how much ſoever a juriſdiction may be expedient, yet no action for words will at preſent lie therein. And it hath always been moſt clearly holden, that as this court cannot meddle with any thing determinable by common law, it therefore can give no pecuniary ſatisfaction or damages; in as much as the quantity and determination thereof is ever of common law cognizance. And therefore this court of chivalry can at moſt order reparation in point of honour; as, to

compel the defendant *mendacium ſibi ipſi imponere*, or to take the lie that he has given upon himſelf, or to make ſuch other ſubmiſſion as the laws of honour may require. As to the other point of its civil juriſdiction, the redreſſing of uſurpations and encroachments in matters of heraldry and coat-armour; it is the buſineſs of this court, according to Sir Matthew Hale, to adjuſt the rights and armorial enſigns, bearings, creſts, ſupporters, pennons, &c.; and alſo rights of places, precedence, where the king's patent or act of parliament, which cannot be over-ruled, by this court, have not already determined it. The proceedings of this court are by petition in a ſummary way: and the trial not by a jury of twelve men, but by witneſſes, or by combat. But as it cannot impriſon, not being a court of record; and as, by the reſolutions of the ſuperior courts, it is now confined to ſo narrow and reſtrained a juriſdiction; it has fallen into contempt. The marſhalling of coat-armour, which was formerly the pride and ſtudy of all the beſt families in the kingdom, is now greatly diſregarded; and has fallen into the hands of certain officers and attendants upon this court, called *heralds*, who conſider it only as a matter of lucre, and not of juſtice: whereby ſuch falſity and confuſion have crept into their records (which ought to be the ſtanding evidence of families, deſcents, and coat armour), that though formerly ſome credit has been paid to their teſtimony, now, even their common ſeal will not be received as evidence in any court of juſtice in the kingdom. But their original viſitation books, compiled when progreſſes were ſolemnly and regularly made into every part of the kingdom, to inquire into the ſtate of families, and to regiſter ſuch marriages and deſcents as were verified to them upon oath, are allowed to be good evidence of pedigrees.

2. As a *criminal* court, when held before the lord high conſtable of England jointly with the earl marſhal, it had juriſdiction over pleas of life and member, ariſing in matters of arms and deeds of war, as well out of the realm as within it. But the criminal as well as civil part of its authority is fallen into entire diſuſe: there having been no permanent high conſtable of England (but only *pro hac vice*, at coronations and the like), ſince the attainder and execution of Stafford Duke of Buckingham, in the 13th year of Henry VIII.; the authority and charge, both in war and peace being deemed too ample for a ſubject; ſo ample, that when the chief juſtice Fineux was aſked by King Henry VIII. how far they extended? he declined anſwering; and ſaid, the deciſion of that queſtion belonged to the law of arms, and not to the law of England.

CHIVES, in botany, are ſlender thread-like ſubſtances, generally placed within the bloſſom, and ſurrounding the POINTALS. They are formed of the woody ſubſtance of the plant.

CHIUM MARMOR, in the natural hiſtory of the ancients, the name of a black marble, called alſo the *lapis obſidianus*. It is very hard, and of a fine black; and, beſide the many uſes which the ancients put it to, is well known among our goldſmiths by the name of the *touchſtone*; moſt of them being furniſhed with nothing better for this purpoſe than a piece of this: though the baſaltes, which might be had plentifully enough, is greatly preferable for thoſe uſes; any black marble, however, that is tolerably hard, will do. There is a very fine and elegantly ſmooth marble, of a compact texture, and fine gloſſy black, but ſhowing no glittering particles when freſh broken, as moſt of the black marbles do. It is extremely hard, and cuts with difficulty, but is capable of the higheſt poliſh of any marble. The ancients had it from Ethiopia and the iſland of Chios; we have it from Italy.

CHIUM Vinum, Chian Wine, or wine of the growth of the iſland of Chios, now Scio, is commended by Dioſcorides as affording good nouriſhment, fit to drink, leſs diſpoſed to intoxicate, endued with the virtue of reſtraining defluxions, and a proper ingredient in ophthalmic medicines. Hence Scribonius Largus directs the dry ingredients in collyria for the eyes to be made up with Chian wine.

CHIUN, or CHEVAN, in Hebrew antiquity. We meet with this word in the prophet Amos, cited in the Acts of the Apoſtles. St Luke reads the paſſage thus: "Ye took up the tabernacle of Moloch, and the ſtar of your god Remphan, figures which ye made to worſhip them." The import of the Hebrew is as follows: "Ye have borne the tabernacle of your kings, and the pedeſtal (the *chiun*) of your images, the ſtar of your gods, which ye made to yourſelves." The Septuagint in all probability read *Repham* or *Revan*, inſtead of *Chiun* or *Chevan*, and took the pedeſtal for a god.

Some ſay that the Septuagint, who made their tranſlation in Egypt, changed the word *Chiun* into that of *Remphan* becauſe they had the ſame ſignification. M. Baſnage, in his book intitled *Jewiſh Antiquities*, after having diſcourſed a good deal upon *Chion* or *Remphan*, concludes that Moloch was the ſun, and *Chion*, *Chiun*, or *Remphan*, the moon.

CHLAMYS, in antiquity, a military habit worn by the ancients over the tunica. It belonged to the patricians, and was the ſame in the time of war that the toga was in the time of peace. This ſort of gown was called *picta*, from the rich embroidery with figures in Phrygian work; and *purpurea*, becauſe the groundwork was purple. The chlamydes of the emperors were all purple, adorned with a golden and embroidered border.

CHLOEIA, in antiquity, a feſtival celebrated at Athens in honour of Ceres, to whom, under the name Χλοη, *i. e. Graſs*, they ſacrificed a ram.

CHLORA, in botany, a genus of the monogynia order, belonging to the octandria claſs of plants. The calyx is octophyllous, the corolla monopetalous and octofid; the capſule unilocular, bivalved, and polyſpermous.

CHLOROSIS, in medicine, a diſeaſe, commonly called the *green-ſickneſs*, incident to young girls. See (the Index ſubjoined to) MEDICINE.

CHOCOLATE, in commerce, a kind of paſte or cake prepared of certain ingredients, the baſis of which is cacao. See CACAO.

The Indians, in their firſt making of chocolate, uſed to roaſt the cacao in earthen pots; and having afterwards cleared it of the huſks, and bruiſed it between two ſtones, they made it into cakes with their hands. The Spaniards improved this method: when the cacao is properly roaſted and well cleaned, they pound it in a mortar, to reduce it into a coarſe maſs, which they afterwards grind on a ſtone till it be of the utmoſt fineneſs: the paſte being ſufficiently ground, is put quite hot into tin moulds, in which it congeals in a very little time. The form of theſe moulds is arbitrary: the cylindrical ones, holding two or three pounds, are the moſt proper; becauſe the bigger the cakes are, the longer they will keep. Obſerve, that theſe cakes are very liable to take any good or bad ſcent, and therefore they muſt be carefully wrapt up in paper, and kept in a dry place. Complaints are made, that the Spaniards mix with the cacao nuts too great a quantity of cloves and cinnamon, beſides other drugs without number, as muſk, ambergreaſe, &c. The grocers of Paris uſe few or none of theſe ingredients: they only chooſe the beſt nuts, which are called *caracca*, from the place from whence they are brought; and with theſe they mix a very ſmall quantity of cinnamon, the freſheſt vanilla, and the fineſt ſugar, but very ſeldom any cloves. In England, the chocolate is made of the ſimple cacao, excepting that ſometimes ſugar and ſometimes vanilla is added.

Chocolate ready made, and cacao paſte, are prohibited to be imported into Britain from beyond the ſeas. If made and ſold in Great Britain, it pays inland duty 1s. 6d. *per lb.* avoirdupoiſe: it muſt be incloſed in papers containing one pound each, and produced at the exciſe-office to be ſtamped. Upon three days notice given to the officer of exciſe, private families may make chocolate for their own uſe, provided no leſs than half an hundred weight of nuts be made at one time.

The chocolate made in Portugal and Spain is not near ſo well prepared as the Engliſh, depending perhaps on the machine employed there, *viz.* the double cylinder, which ſeems very well calculated for exact triture. If perfectly prepared, no oil appears on the ſolution. London chocolate gives up no oil like the foreign; and it alſo may, in ſome meaſure, depend on the thickneſs of the preparation. The ſolution requires more care than is commonly imagined. It is proper to break it down, and diſſolve it thoroughly in cold water by milling it with the chocolate ſtick. If heat is applied, it ſhould be done ſlowly: for, if ſuddenly, the heat will not only coagulate it, but ſeparate the oil; and therefore much boiling after it is diſſolved, is hurtful. Chocolate is commonly required by people of weak ſtomachs; but often rejected for want of proper preparation. When properly prepared, it is eaſily diſſolved; and an excellent food where a liquid nutrient vegetable one is required, and is leſs flatulent than any of the farinacea.

Mr Henly, an ingenious electrician, has lately diſcovered that chocolate, freſh from the mill, as it cools in the tin-pans into which it is received, becomes ſtrongly electrical; and that it retains this property for ſome time after it has been turned out of the pans, but ſoon loſes it by handling. The power may be once or twice renewed by melting it again in an iron ladle, and pouring it into the tin pans as at firſt; but when it becomes dry and powdery, the power is not capable of being revived by ſimple melting: but if a ſmall quantity of olive oil be added, and well mixed with the chocolate in the ladle, its electricity will be completely reſtored by cooling it in the tin-pan as before. From this experiment he conjectures, that there is a great affinity between phlogiſton and the electric fluid, if indeed they be not the ſame thing.

Chocolate-Nut Tree. See CACAO.

CHOENIX, χοινιξ, an ancient dry meaſure, containing the 48th part of a *medimnus*, or ſix buſhels.

CHOERILUS, a tragic poet of Athens about the 64th Olympiad. He wrote 150 tragedies, of which 13 had obtained the prize.—An hiſtorian of Samos.—Two other poets, one of whom was very intimate with Herodotus. He wrote a poem on the victory which the Athenians had obtained over Xerxes; and on account of the excellence of the compoſition he received a piece of gold for each verſe from the Athenians. The other was one of Alexander's flatterers and friends.

CHOERINÆ, in antiquity, a kind of ſea-ſhells, with which the ancient Greeks uſed to give their ſuffrage or vote.

CHOIR, that part of the church or cathedral where choiriſters ſing divine ſervice; it is ſeparated from the chancel where the communion is celebrated, and alſo from the nave of the church where the people are placed: the patron is ſaid to be obliged to repair to the choir of the church. It was in the time of Conſtantine that the choir was ſeparated from the nave. In the twelfth century they began to incloſe it with walls; but the ancient baluſtrades have ſince been reſtored, out of a view to the beauty of architecture.

CHOIR in nunneries, is a large hall adjoining to the body of the church, ſeparated by a grate, where the nuns ſing the office.

CHOISI (Francis Timoleon de), dean of the cathedral of Bayeux, and one of the forty of the French academy, was born at Paris in 1644. In 1685, he was ſent with the chevalier de Chamont to the king of Siam, and was ordained prieſt in the Indies by the apoſtolical vicar. He wrote a great number of works, in a polite, florid, and eaſy ſtile; the principal of which are, 1. Four dialogues on the Immortality of the Soul, *&c.* 2. Account of a voyage to Siam. 3. An Eccleſiaſtical Hiſtory, in 11 vols. 4to. 4. Life of David, with an interpretation of the Pſalms. 5. Life of Solomon, *&c.* he died at Paris, in 1724.

CHOLEDOCHUS, in anatomy, a term applied to a canal or duct, called alſo *ductus communis*; formed of the union of the porus bilarius and ductus cyſticus. The word comes from χολη, *choler*; and δεχομαι, *I receive*, or *contain*.

The choledochus ductus paſſing obliquely to the lower-end of the duodenum, ſerves to convey the bile from the liver to the inteſtines. See ANAT. n° 97.

CHOLER. See BILE.

CHOLERA MORBUS, a ſudden eruption or overflowing of the bile or bilious matters both upwards and downwards. See (the *Index* ſubjoined to) MEDICINE.

CHOMER, or OMER. See CORUS.

CHONDRILLA, in botany, a genus of the polygamia equalis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; the calyx calyculated; the pappus ſimple and ſtalked; the florets in a manifold ſeries.

CHONDROPTERYGII, in ichthyology, a term

formerly applied to the order of fiſhes now called *amphibia nantes* by Linnæus. See AMPHIBIA.

CHOP-CHURCH, or CHURCH-CHOPPER, a name, or rather nick-name, given to parſons who make a practice of exchanging benefices. See PERMUTATION.

Chop-church occurs in an ancient ſtatute as a lawful trade or occupation; and ſome of the judges ſay it was a good addition. Brook holds that it was no occupation, but a thing permiſſible by law.

CHOPIN, or CHOPINE, a liquid meaſure uſed both in Scotland and France, and equal to half their pint. See PINT and MEASURE.

CHOPIN (Rene), a famous civilian born at Bailleul in Anjou in 1537. He was advocate in the parliament of Paris, where he pleaded for a long time with great reputation. He at laſt ſhut himſelf up in his cloſet; and compoſed many works, which have been collected together, and printed in 6 vols, folio. He died at Paris in 1606.

CHORAL, ſignifies any perſon that, by virtue of any of the orders of the clergy, was in ancient times admitted to ſit and ſerve God in the choir.

Dugdale, in his hiſtory of St Paul's Church, ſays, that there were with the chorus formerly ſix vicars choral belonging to that church.

CHORASSAN, or KHORASSAN, a province of Perſia adjoining to Uſbec Tartary. This was the ancient Bactria, and the birth-place of Kouli Khan.

CHORAX, or CHARAX. See CHARACENE.

CHORAZIM, or CHORAZIN, (Luke, Mathew), a town of Galilee: whoſe wretched incredulity Chriſt deplores: now deſolate, at two miles diſtance from Capernaum.

CHORD, or CORD, primarily denotes a ſlender rope or cordage *. The word is formed of the Latin, *chorda*, and that from the Greek, *χορδη, a gut,* whereof ſtrings may be made.

CHORD, in geometry, a right line drawn from one part of an arch of a circle to another. Hence,

CHORD *of an Arch*, is a right line joining the extremities of that arch.

CHORD, in muſic, the union of two or more ſounds uttered at the ſame time, and forming together an entire harmony.

The natural harmony produced by the reſonance of a ſounding body, is compoſed of three different ſounds, without reckoning their octaves; which form among themſelves the moſt agreeable and perfect chord that can poſſibly be heard: for which reaſon they are called, on account of their excellence, *perfect chords*. Hence, in order to render this harmony complete, it is neceſſary that each cord ſhould at leaſt conſiſt of three ſounds. The trio is likewiſe found by muſicians to include the perfection of harmony; whether becauſe in this all the cords, and each in its full perfection, are uſed; or, becauſe upon ſuch occaſions as render it improper to uſe them all, and each in its integrity, arts have been ſucceſsfully practiſed to deceive the ear, and to give it contrary perſuaſion, by deluding it with the principal ſounds of each *chord*, in ſuch a manner as to render it forgetful of the other ſounds neceſſary to their completion. Yet the octave of the principal ſound produces new relations, and new conſonances, by the completion of the intervals: they commonly add this octave, to have the aſſemblage of all the conſonances in one and the ſame *chord*; (See CONSONANCE.) Moreover, the addition of the diſſonance (ſee DISCORD), producing a fourth ſound ſuperadded to the perfect chord, it becomes indiſpenſibly neceſſary, if we would render the cord full, that we ſhould include a fourth part to expreſs this diſſonance. Thus the ſeries of chords can neither be complete nor connected but by means of four parts.

Chords are divided into perfect and imperfect. The *perfect chord* is that which we have lately deſcribed; which is compoſed of the fundamental ſound below, of its third, is fifth, and its octave: they are likewiſe ſubdivided into major and minor, according as the thirds which enter into their compoſition are flat or ſharp: (See INTERVAL.) Some authors likewiſe give the name of *perfect* to all chords, even to diſſonances, whoſe fundamental ſounds are below. Imperfect *chords* are thoſe in which the ſixth, inſtead of the fifth, prevails, and in general all thoſe whoſe loweſt are not their fundamental ſounds. Theſe denominations, which had been given before the fundamental baſs was known, are now moſt unhappily applied: thoſe of chords *direct* and *reverſed*, are much more ſuitable in the ſame ſenſe.

Chords are once more divided into conſonances and diſſonances. The chords denominated *conſonances*, are the perfect chord, and its derivatives: every other chord is a *diſſonance*.

A table of both, according to the ſyſtem of M. Rameau, may be ſeen in Rouſſeau's Muſical Dictionary, vol. I. p. 27.

After the table to which our readers have been remitted, Rouſſeau adds the following obſervations, which are at the ſame time ſo juſt and ſo important, that we ſhould be very ſorry if they eſcape the reader's attention.

At the words *harmony*, *fundamental baſs*, *compoſition*, &c. he promiſes to treat concerning the manner of uſing all the chords to form regular harmony; and only adds, in this place, the ſubſequent reflections.

1. It is a capital error to imagine, that the methods of inverting the ſame chord are in all caſes equally eligible for the harmony and for the expreſſion. There is not one of theſe different arrangements but had its proper character. Every one feels the contraſt between the ſoftneſs of the falſe fifth, and the grating ſound of the tritone, though the one of theſe intervals is produced by a method of inverting the other. With the ſeventh diminiſhed, and the ſecond redundant, the caſe is the ſame with the interval of the ſecond in general uſe, and the ſeventh. Who does not feel how much more vocal and ſonorous the fifth appears when compared with the fourth? The *chord* of the great ſixth, and that of the leſſer ſixth minor, are two forms of the ſame fundamental *chord*: but how much leſs is the one harmonious than the other? On the contrary, the *chord* of the leſſer ſixth major is much more pleaſing and cheerful than that of the falſe fifth. And only to mention the moſt ſimple of all *chords*, reflect on the majeſty of the perfect chord, the ſweetneſs of that which is called the chord of the ſixth, and the inſipidity of that which is compoſed of

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* See Cordage.

a ſixth and a fourth; all of them, however, compoſed of the ſame ſounds. In general, the redundant intervals, the ſharps in the higher part, are proper by their ſeverity to expreſs violent emotions of mind, ſuch as anger and the rougher paſſions. On the contrary, flats in the higher parts, and diminiſhed intervals, form a plaintive harmony, which melts the heart. There are a multitude of ſimilar obſervations, of which when a muſician knows how to avail himſelf, he may command at will the affections of thoſe who hear him.

2. The choice of ſimple intervals is ſcarcely of leſs importance than that of the *chords*, with regard to the ſtations in which they ought to be placed. It is, for inſtance, in the lower parts that the fifth and octave ſhould be uſed in preference; in the upper parts, the third and ſixth are more proper. If you tranſpoſe this order, the harmony will be ruined even tho' the ſame *chords* are preſerved.

3. In a word, the *chords* are rendered ſtill more harmonious, by being approximated and only divided by the ſmalleſt practicable intervals, which are more ſuitable to the capacity of the ear than ſuch as are remote. This is what we call *contracting* the harmony, an art which few compoſers have ſkill and abilities enough to put in practice. The limits in the natural compaſs of voices, afford an additional reaſon for leſſening the diſtance of the intervals, which compoſe the harmony of the chorus, as much as poſſible. We may affirm, that a chorus, is improperly compoſed, when the diſtance between the *chords* increaſes; when thoſe who perform the different parts are obliged to ſcream; when the voices riſe above their natural extent, and are ſo remotely diſtant one from the other that the perception of harmonical relations between them is loſt.

We ſay likewiſe, that an inſtrument is in *concord* when the intervals between its fixed ſounds are what they ought to be; we ſay in this ſenſe, that the *chords* of an inſtrument are true or falſe, that it preſerves or does not preſerve its *chords*. The ſame form of ſpeaking is uſed for two voices which ſing together, or for two ſounds which are heard at the ſame time, whether in uniſon or in parts.

Chords, or *Cords, of Muſical inſtruments*, are ſtrings, by the vibration of which the ſenſation of ſound is excited, and by the diviſions of which the ſeveral degrees of tone are determined.

CHORDEE, in medicine and ſurgery, a ſymptom attending a gonorrhœa, conſiſting in a violent pain under the frenum, and along the duct of the urethra during the erection of the penis, which is incurvated downwards. Theſe erections are frequent and involuntary.

CHOREA Sancti Viti. See *Vitus's Dance*.

CHOREPISCOPUS, an officer in the ancient church, about whoſe function the learned are extremely divided, The word comes from χωρος, a *region, little country*, and επισκοπος, *a biſhop*, or *overſeer*.

The chorepiſcopi were ſuffragan or local biſhops, holding a middle rank between biſhops and preſbyters, and delegated to exerciſe epiſcopal juriſdiction within certain diſtricts, when the boundaries of particular churches, over with ſeparate biſhops preſided, were conſiderably enlarged. It is not certain when this office was firſt introduced: ſome trace it to the cloſe of the firſt century; others tell us, that chorepiſcopi were not known in the eaſt till the beginning of the fourth century: and in the weſt about the year 439. They ceaſed both in the eaſt and weſt in the tenth century.

Chorepiscopus is alſo the name of a dignity ſtill ſubſiſting in ſome cathedrals, particularly in Germany; ſignifying the ſame with *chori epiſcopus*, or "biſhop of the choir." The word, in this ſenſe, does not come from χωρος, *place*, but χορος, *quoir*, &c. In the church of Cologne, &c. the firſt chanter is called *chorepiſcopus*.

CHOREUS, Χορειος, a foot in the ancient poetry, more commonly called *trochæus*. See Trochee.

CHORIAMBUS, in ancient poetry, a foot conſiſting of four ſyllables, whereof the firſt and laſt are long, and the two middle ones are ſhort; or, which is the ſame thing, it is made up of a trochæus and iambus; ſuch is the word *nobilitas*.

CHORION, in anatomy, the exterior membrane which inveſts the foetus in the uterus. See Foetus.

CHOROBATA, or Chorobates, a kind of water level among the ancients, of the figure of the letter T, according to Vitruvius's deſcription.

CHOROGRAPHY, the art of making a map of ſome country or province.

Chorography differs from geography, as the deſcription of a particular country is different from that of the whole earth; and from topography, as the deſcription of a country is different from that of a town or diſtrict. See the articles Geography, Topography, and Map.

CHOROIDES, or Choroeides, in anatomy, a term applied to ſeveral parts of the body; bearing ſome reſemblance to the chorion. The word is formed from χοριον, *chorion*, and ειδος, *likeneſs*.

Choroides is particularly uſed for the inner membrane which immediately inveſts the brain; ſo called as being intermingled with a great number of bloodveſſels, like the *chorion*: but more uſually denominated the *pia mater*, or *meninx tenuis*.

Plexus or *Lacis* Choroides, is a knot of veins and arteries in the anterior ventricle of the brain, woven out of the branches of the carotid.

Choroides is alſo applied to the inner and poſterior tunic of the eye, immediately under the ſclerotica. It is ſoft, thin, and black; and its inner or concave ſurface is very ſmooth and poliſhed. It has its name from its being interſperſed with veſſels.

CHORUS, in dramatic poetry, one or more perſons preſent on the ſtage during the repreſentation, and ſuppoſed to be by-ſtanders without any ſhare in the action.

Tragedy in its origin was no more than a ſingle chorus, who trod the ſtage alone, and without any actors, ſinging dithyrambics or hymns in honour of Bacchus. Theſpis, to relieve the chorus, added an actor, who rehearſed the adventures of ſome of their heroes; and Æſchylus, finding a ſingle perſon too dry an entertainment, added a ſecond, at the ſame time reducing the ſinging of the chorus, to make more room for the recitation. But when once tragedy began to be formed, the recitative, which at firſt was intended only as an acceſſory part to give the chorus a breathing time, became a principal part of the tragedy. At length, however, the chorus became inſerted and incorporated into the action: ſometimes it was to ſpeak; and then their chief, whom they called *coryphæus*, ſpoke in behalf of the reſt: the ſinging was performed by the whole company; ſo that when the coryphæus ſtruck into a ſong, the chorus immediately joined him.

The chorus ſometimes alſo joined the actors in the courſe of the repreſentation, with their plaints and lamentations on account of any unhappy accidents that befel them: but the proper function, and that for which it ſeemed chiefly retained, was to ſhow the intervals of the acts: while the actors were behind the ſcenes, the chorus engaged the ſpectators; their ſongs uſually turned on what was exhibited, and were not to contain any thing but what was ſuited to the ſubject, and had a natural connection with it; ſo that the chorus concurred with the actors for advancing the action. In the modern tragedies the chorus is laid aſide, and the fiddles ſupply its place M. Dacier looks on this retrenchment as of ill conſequence, and thinks it robs tragedy of a great part of its luſtre; he therefore judges it neceſſary to re-eſtabliſh it, not only on account of the regularity of the piece, but alſo to correct, by prudent and virtuous reflections, any extravagances that might fall from the mouths of the actors when under any violent paſſion.

M. Dacier obſerved alſo, that there was a chorus, or grex, in the ancient comedy: but this is ſuppreſſed in the new comedy, becauſe it was uſed to reprove vices by attacking particular perſons; as the chorus of the tragedy was laid aſide to give the greater probability to thoſe kinds of intrigue which require ſecrecy.

Chorus, in muſic, is when, at certain periods of a ſong, the whole company are to join the ſinger in repeating certain couplets or verſes.

CHOSE, *(Fr.)* "a thing;" uſed in the common law with divers epithets; as *choſe local*, *choſe tranſitory*, and *choſe in action*. Choſe local is ſuch a thing as is annexed to a place, as a mill and the like; choſe tranſitory, is that thing which is moveable, and may be taken away, or carried from place to place; and choſe in action is a thing incorporeal, and only a *right*, as an obligation for debt, annuity, &c. And generally all cauſes of ſuit for any debt, duty, or wrong, are to be accounted choſes in action: and it ſeems, choſe in action may be alſo called *choſe in ſuſpence*; becauſe it hath no real exiſtence, or being, nor can properly be ſaid to be in our poſſeſſion.

CHOSROES I. the Great, king of Perſia, after his father Cabades, A. D. 532. He made peace with the Romans: but broke it the third year, and forced Juſtinian to a diſadvantageous peace. Afterward, he was ſo ſwelled with his victories, as to bid the emperor's ambaſſador follow him for audience to Cæſarea: but Tiberius ſent an army under Juſtinian; who made himſelf maſter of the country, and put Choſroes to death in 586.

Chosroes II. His ſubjects put his father Hormiſdas in priſon, and the ſon upon the throne of Perſia. He uſed his father tenderly at firſt; but afterwards cauſed him to be put to death. This, together with his killing ſome of the nobility, obliged him to fly: he gave his horſe the bridle, which carried him into a town of the Romans, where Mauricius the emperor received him kindly, and ſent an army under Narſes, which ſet him again upon the throne. He took Jeruſalem; after this he made himſelf maſter of Libya and Egypt, and carried Carthage. Heraclius ſued for peace; which was offered him on condition, *That he and his ſubjects ſhould deny Jeſus Chriſt*: Hereupon Heraclius attacked him with ſucceſs, and put him to flight. His own ſon purſued him, and he was ſtarved in priſon in 627.

CHOUCH, in ornithology, the trivial name of a ſpecies of Corvus.

CHOUS, in the eaſtern military orders, the title of the meſſengers of the divan of Janiſaries. There are ſeveral degrees of honour in this poſt. When a perſon is firſt advanced to it, he is called a *cuchuk*, or little *chous*; after this he is advanced to be the *alley chous*; that is, the meſſenger of ceremonies; and from this, having paſſed through the office of *petelma*, or procurator of the effects of the body, he is advanced to be the *bas chous*.

CHOWDER-beer, a provincial phraſe of Devonſhire, in England, denoting a cheap and eaſily prepared drink, highly commended for preventing the ſcurvy in long voyages, or for the cure of it where it may have been contracted. It is prepared in the following manner: Take twelve gallons of water, in which put three pounds and a half of black ſpruce: boil it for three hours, and having taken out the fir or ſpruce, mix with the liquor ſeven pounds of melaſſes, and juſt boil it up; ſtrain it through a ſieve, and when milk warm put to it about four ſpoonfuls of yeſt to work it. In two or three days ſtop the bung of the caſk; and in five or ſix days, when fine, bottle it for drinking. Two gallons of melaſſes are ſufficient for an hogſhead of liquor; but if melaſſes cannot be procured, treacle or coarſe ſugar will anſwer the purpoſe.

CHREMNITZ, the principal of the nine-towns in Upper Hungary, ſituated about 68 miles north-eaſt of Preſburg, and ſubject to the houſe of Auſtria. E. Long. 19. N. Lat. 48. 45.

CHRENECRUDA, a term occurring in writers of the middle age, and expreſſing a cuſtom of thoſe times; but its ſignification is doubtful. It is mentioned in *Lege Salica*, Tit. 61. which ſays, he who kills a man, and hath not wherewithal to ſatisfy the law or pay the fine, makes oath that he has delivered up every thing he was poſſeſſed of; the truth of which muſt be confirmed by the oaths of 12 other perſons. Then he invites his next relations by the father's ſide to pay off the remainder of the fine, having firſt made over to them all his effects by the following ceremony. He goes into his houſe, and taking in his hand a ſmall quantity of duſt from each of the four corners, he returns to the door, and with his face inwards throws the duſt with his left hand over his ſhoulders upon his neareſt of kin. Which done, he ſtrips to his ſhirt; and coming out with a pole in his hand, jumps over the hedge. His relations, whether one or ſeveral, are upon this obliged to pay off the compoſition for the murder. And if theſe (or any one of them) are not able to pay, *iterum ſuper illum chrenecruda, qui pauperior eſt, jactat, et ille totam legem componat.* Whence it appears, that *chrenecruda jactare*, is the ſame with throwing the duſt, gathered from the four corners of the houſe. Goldaſtus and Spelman tranſlate it *viridem herbam*, "green graſs," from the German *gruen kraut*, or from the Dutch *groen*, "green," and *grand*, "graſs." Wendelinus is of a contrary opinion, who thinks that by this word *denotari purificationis approbationem*, from *chrein*, "pure, chaſte, clean;" and *keuren*, "to prove," ſo that it muſt refer to the oaths of the twelve jurors. Be this as it will, king Childebert reformed this law by a decree, chap. 15. both becauſe it favoured of pagan ceremonies, and becauſe ſeveral perſons were thereby obliged to make over all their effects: *De chrenecruda lex quam paganorum tempore obſervabant, deinceps nunquam valeat, quia per ipſam cecidit multorum poteſtas.*

CHRISM (from χριω, *I anoint*), oil conſecrated by the biſhop, and uſed in the Romiſh and Greek churches, in the adminiſtration of baptiſm, confirmation, ordination, and extreme unction, which is prepared on holy Thurſday with much ceremony. In Spain it was anciently the cuſtom for the biſhop to take one third of a ſol for the chriſm diſtributed to each church, on account of the balſam that entered its compoſition.

Du Cange obſerves, that there are two kinds of chriſm; the one prepared of oil and balſam, uſed in baptiſm, confirmation, and ordination; the other of oil alone, conſecrated by the biſhop, uſed anciently for the catechumens, and ſtill in extreme unction. The Maronites, before their reconciliation with Rome, beſides oil and balſam, uſed muſk, ſaffron, cinnamon, roſes, white frankincenſe, and ſeveral other drugs mentioned by Rynaldus, in 1541, with the doſes of each. The Jeſuit Dandini, who went to mount Libanus in quality of the pope's nuncio, ordained, in a ſynod held there in 1596, that chriſm for the future ſhould be made only of two ingredients, oil and balſam; the one repreſenting the human nature of Jeſus Chriſt, the other his divine nature. The action of impoſing the chriſm is called *chriſmation*: this the generality of the Romiſh divines hold to be the next matter of the ſacrament of confirmation.

The chriſmation in baptiſm is performed by the prieſt; that in confirmation by the biſhop; that in ordination, &c. is more uſually ſtyled *unction*.

CHRISM Pence, CHRISMATIS Denarii, or *CHRISMALES Denarii*, a tribute anciently paid to the biſhop by the pariſh-clergy, for their chriſm, conſecrated at Eaſter for the enſuing year: this was afterwards condemned as ſimoniacal.

CHRISOM, CHRISMALE, was anciently the face-cloth or piece of linen laid over the child's head when it was baptized. Whence, in the bills of mortality, children who die in the month are called *chriſoms*. The time between the child's birth and baptiſm was alſo called *chriſomus*.

CHRIST, an appellation ſynonymous with *Meſſiah*, uſually added to Jeſus: and, together therewith, denominating the Saviour of the world. See CHRISTIANITY and MESSIAH.

The word χριστὸς ſignifies *anointed*, from χριω, *inungo*, "I anoint." Sometimes the word *Chriſt* is uſed ſingly, by way of *antonomaſis*, to denote a perſon ſent from God, as an anointed prophet, king, or prieſt.

Order of CHRIST, a military order, founded by Dionyſius I. king of Portugal, to animate his nobles againſt the Moors.—The arms of this order are gules, patriarchal croſs, charged with another croſs argent: they had their reſidence at firſt at Caſtromarin; afterwards they removed to the city of Thomar, as being nearer to the Moors of Andaluſia, and Eſtremadura.

CHRIST is alſo the name of a military order in Livonia, inſtituted in 1205 by Albert biſhop of Riga. The end of this inſtitution was to defend the new Chriſtians, who were converted every day in Livonia, but were perſecuted by the heathens. They wore on their cloaks a ſword with a croſs over it, whence they were alſo denominated *brothers of the ſword*.

CHRIST-Burgh, a town of Poland, near the lake Drauſen, and about three Poliſh miles from Marienburgh.

CHRIST-Church, a borough-town of Hampſhire, in England, 30 miles ſouth-weſt of Wincheſter, near the ſea-coaſt. W. Long. 2. N. Lat. 50. 40. It ſends two members to parliament.

CHRIST-Thorn, in botany. See RHAMNUS.

CHRISTIAN. See CHRISTIANITY and CHRISTIANS.

Moſt CHRISTIAN King, one of the titles of the king of France.

The French antiquarieſt race the origin of this appellation up to Gregory the Great, who, writing a letter to Charles Martel, occaſionally gave him that title, which his ſucceſſors have ſince retained.

CHRISTIAN Religion, that inſtituted by Jeſus Chriſt. See CHRISTIANITY.

1 Origin of the word.

CHRISTIANITY, the religion of Chriſtians. The word is analogically derived, as other abſtracts from their concretes, from the adjective *Chriſtian*. This again is derived from the name Χριστος, *Chriſtus*, from the word χριω, *I anoint*. Chriſt is called *the anointed*, from a cuſtom which extenſively prevailed in antiquity, and was originally ſaid to be of divine inſtitution, of anointing perſons in the ſacerdotal or regal character, as a public ſignal of their conſecration to their important offices, and as a teſtimony that heaven itſelf was the guarantee of that relation which then commenced between the perſons thus conſecrated and their ſubordinates.

2 By what name the apoſtles were firſt diſtinguiſhed.

The diſciples of Jeſus, after the death of their teacher, had for ſome time been called *Nazarenes*, from Nazareth in Galilee where he dwelt; which afterwards became the deſignation of a particular ſect. They, who adopted the principles and profeſſed the religion which he taught, were firſt diſtinguiſhed by the name of *Chriſtians* at Antioch. That profeſſion, and thoſe doctrines, we now proceed to delineate with as much perſpicuity as the limits of our plan will admit, yet with the conciſeneſs which a work ſo multiform and extenſive requires.

3 Delineation of Chriſtianity.

When a Chriſtian is interrogated concerning the nature and foundation of his faith and practice, his ultimate reference, his laſt appeal, is to the facts, the doctrines, and the injunctions, contained in the books of the Old and New Teſtament. From theſe, therefore, and from theſe alone, muſt every fair account, or the materials of which it is compoſed, be extracted or deduced. Other formularies, or confeſſions of faith, may, according to the Chriſtian, deſerve more or leſs attention, as they are more or leſs immediately contained or implied in the ſcriptures. But whatever is not actually expreſſed in, or deduced by fair and neceſſary conſequence from, theſe writings, muſt be regarded as merely human; and can have no other title to our aſſent and obſervation than what they derive from their conformity with the ſcriptures, with the dictates and feelings of a reformed and cultivated mind, or with thoſe meaſures which are found expedient and uſeful in human life. But as thoſe books, from whence the Chriſtian inveſtigates his principles of belief and rules of conduct, have been variouſly interpreted by different profeſſors and commentators, theſe diverſities have given birth to a multiplicity of different ſects. It cannot, therefore, be expected, that any one who undertakes to give an account of Chriſtianity, ſhould comprehend all the writings and opinions which have been propagated and exhibited by hiſtorical, ſyſtematical, or polemical authors. Theſe, if at all contained in ſuch a work as this, ſhould be ranged under their proper articles, whether ſcientifical, controverſial, or biographical. It is our preſent buſineſs, if poſſible, to confine ourſelves to a detail of ſuch facts and doctrines as in the ſtrict and primitive ſenſe of the word, are *catholic*, or in other expreſſions, to ſuch as uniformly have been, and ſtill are, recogniſed and admitted by the whole body of Chriſtians.

4
Account of Chriſtianity, whence deducible.

We have already ſaid that theſe, or at leaſt the greateſt number of them, appeal to the ſcriptures of the Old and New teſtament as the ultimate ſtandard, the only infallible rule of faith and manners. If you aſk them, by what authority theſe books claim an abſolute right to determine the conſciences and underſtandings of men with regard to what they ſhould believe and what they ſhould do? they will anſwer you, that all ſcripture, whether for doctrine, correction, or reproof, was given by immediate inſpiration from God.

5
The nature of its evidences.

If again you interrogate them how thoſe books, which they call *Scripture*, are authenticated? they reply, that the evidences by which the Old and New Teſtament are proved to be the Word of God, are either external or internal. The *external* may again be divided into direct or collateral. The direct evidences are ſuch as ariſe from the nature, conſiſtency, and probability, of the facts; and from the ſimplicity, uniformity, competency, and fidelity, of the teſtimonies by which they are ſupported. The collateral evidences, are either the ſame occurences ſupported by Heathen teſtimonies, or others which concur with and corroborate the hiſtory of Chriſtianity. Its *internal* evidences ariſe either from its exact conformity with the character of God, from its aptitude to the frame and circumſtances of man, or from thoſe ſupernatural convictions and aſſiſtances which are impreſſed on the mind by the immediate operation of the divine Spirit. Theſe can only be mentioned in a curſory manner in a detail ſo conciſe as the preſent.

6
How Chriſtianity is ſupported by facts.

Such facts as are related in the hiſtory of his religion, the Chriſtian aſſerts to be not only conſiſtent each with itſelf, but likewiſe one with another. Hence it is, that, by a ſeries of antecedents and conſequences, they corroborate each other, and form a chain which cannot be broken but by an abſolute ſubverſion of all hiſtorical authenticity. Nor is this all: for, according to him, the facts on which Chriſtianity is founded, not only conſtitute a ſeries of themſelves, but are likewiſe in ſeveral periods the beſt reſources for ſupplying the chaſms in the hiſtory of our nature, and preſerving the tenor of its annals entire. The facts themſelves are either natural or ſupernatural. By natural facts we mean ſuch occurrences as happen or may happen from the various operations of mechanical powers, or from the interpoſition of natural agents without higher aſſiſtants. Such are all the common occurrences of hiſtory, whether natural, biographical, or civil. By ſupernatural facts, we mean ſuch as could not have been produced without the interpoſition of Deity, or at leaſt of powers ſuperior to the laws of mechaniſm or the agency of embodied ſpirits. Among theſe may be reckoned the immediate change of water into wine, the inſtantaneous cure of diſeaſes without the intervention of medicine, the reſuſcitation of the dead, and others of the ſame kind. In this order of occurrences may likewiſe be numbered the exertions and exhibitions of prophetic power, where the perſons by whom theſe extraordinary talents were diſplayed could neither by penetration nor conjecture unravel the mazes of futurity, and trace the events of which they ſpoke from their primary cauſes to their remote completions. So that they muſt have been the paſſive organs of ſome ſuperior Being, to whom the whole concatenation of cauſes and effects which operate from the origin to the conſummation of nature, was obvious at a glance of thought.

7
Natural facts, what, and how conducive to the elucidation of hiſtory.

It has already been hinted, that the facts which we have called *natural*, not only agree with the analogy of human events, and corroborate each other, but in a great many emergencies nobly illuſtrate the hiſtory of nature in general. For this a Chriſtian might offer one inſtance, of which philoſophy will not perhaps be able to produce any tolerable ſolution, without having recourſe to the facts upon which Chriſtianity is founded. For if mankind were originally deſcended from one pair alone, how ſhould it have happened that long before the date of authentic hiſtory every nation had its own diſtinct language? Or if it be ſuppoſed, as ſome late philoſophers have maintained, that man is an indigenous animal in every country; or, that he was originally produced in, and created for, each particular ſoil and climate which he inhabits; ſtill it may be demanded, whence the prodigious multiplicity, the immenſe diverſity, of languges? Is the language of every nation intuitive, or were they dictated by exigencies, and eſtabliſhed by convention? If the laſt of theſe ſuppoſitions be true, what an immenſe period of time muſt have paſſed? How many revolutions of material and intellectual nature muſt have happened? What acceſſions of knowledge, refinement, civilization, muſt human intercourſe have gained before the formation and eſtabliſhment even of the moſt ſimple, imperfect, and barbarous language? Why is a period ſo vaſt, obliterated ſo entirely as to eſcape the retroſpect of hiſtory, of tradition, and even of fable itſelf; Why was the acquiſition and improvement of other arts ſo infinitely diſtant from that of language, that the aera of the latter is entirely loſt, whilſt we can trace the former from their origin through the various gradations of their progreſs.

8
This obſcurity inexplicable but by the Moſaic account.

Theſe difficulties, inextricable by all the lights of hiſtory or philoſophy, this more than Cimmerian darkneſs, is immediately diſſipated by the Moſaic account of the confuſion of tongues: wiſely intended to ſeparate the tribes of men one from another, to repleniſh the ſurface of the globe, and to give its multiplied inhabitants thoſe opportunities of improvement which might be derived from experiment and induſtry, variouſly exerted, according to the different ſituations in which they were placed, and the different employments which theſe ſituations dictated. Thus the time of nature's exiſtence is limited to a period within the ken of human intellect. Thus whatever has happened might have happened during the preſent mode of things; whereas, if we deduce the orign and diverſity of language from a period ſo remotely diſtant as to be abſolutely loſt, and entirely detached from all the known occurences and viciſſitudes of time, we muſt admit the preſent forms and arrangments of things to have ſubſiſted perhaps for a much longer duration than any mechanical philoſopher will allow to be poſſible. Other inſtances equally pregnant with conviction might be multiplied; but, precluded by the limits of our plan, we proceed to a ſingle obſervation upon the facts which have been termed *ſupernatural*.

9
Miracles how conducive to prove the truth of Chriſtianity.

Of thoſe changes which happen in ſenſible objects, ſenſation alone can be judge. Reaſon has nothing to do in the matter. She may draw concluſions from the teſtimonies of ſenſe, but can never refute them. If, therefore, our ſenſes inform us that ſnow is white, in vain would the moſt learned and ſubtile philoſopher endeavour to convince us that it was of a contrary colour. He might confound us, but never could perſuade us. Such changes, therefore, as appear to happen in ſenſible objects, muſt either be real or fallacious. If real, the miracle is admitted; if falacious, there muſt be a cauſe of deception equally unaccountable from the powers of nature, and therefore equally miraculous. If the veracity or competency of the witneſſes be queſtioned, the Chriſtian anſwers, that they muſt be competent, becauſe the facts which they relate are not beyond their capacity to determine. They muſt likewiſe be faithful, becauſe they had no ſecular motives for maintaining, but many for ſuppreſſing or diſguiſing, what they teſtified. Now the Chriſtian appeals to the whole ſeries of hiſtory and experience, whether ſuch a man is or can be found, as will offer a voluntary, ſolemn, and deliberate ſacrifice of truth at the ſhrine of caprice.

10
Prophecy evident by its own nature independent of its vehicles.

But ſuch facts as after a long continuance of time have been found exactly agreeable to predictions formerly emitted, muſt ſuperſede the fidelity of teſtimony, and infallibly prove that the event was known to the Being by whom it was foretold. In vain has it been urged, that prophecies are ambiguous and equivocal. For though they may prefigure ſubordinate events, yet if the grand occurrences to which they ultimately relate, can alone fulfil them in their various circumſtances, and in their utmoſt extent, it is plain, that the Being by whom they were revealed muſt have been actually preſcient of thoſe events, and muſt have had them in view when the predictions were uttered. For this ſee a learned and ingenious Diſſertation on the Credibility of Goſpel-hiſtory, by Dr M'Knight; where the evidences urged by the Chriſtian in defence of his tenets, which appear detached and ſcattered through innumerable volumes, are aſſembled and arranged in ſuch a manner as to derive ſtrength and luſtre from the method in which they are diſpoſed, without diminiſhing the force of each in particular. See alſo the works of Dr Hurd: conſult likewiſe thoſe of Newton, Sherlock Chandler, &c. For the evidences of thoſe preternatural facts which have been termed *miracles*, the reader may peruſe a ſhort but elegant and concluſive defence of theſe aſtoniſhing phenomena, in anſwer to Mr Hume, by the Rev. George Campbell, D. D.

11
Properties common to all religions.

It muſt be obvious to every reflecting mind, that whether we attempt to form the idea of any religion *a priori*, or contemplate thoſe which have been already exhibited, certain facts, principles, or *data*, muſt be pre-eſtabliſhed, from whence will reſult a particular frame of mind and courſe of action ſuitable to the character and dignity of that Being by whom the religion is enjoined, and adapted to the nature and ſituation of thoſe agents who are commanded to obſerve it. Hence *Chriſtianity* may be divided into *credenda* or doctrines, and *agenda* or precepts.

12
Chriſtian theology.

As the great foundation of his religion, therefore, the Chriſtian believes the exiſtence and government of one eternal and infinite God, who, for ever retains in himſelf the cauſe of his own exiſtence, and inherently poſſeſſes all thoſe perfections which are compatible with his nature: ſuch are, his almighty power, omniſcient wiſdom, infinite juſtice, boundleſs goodneſs, perfect holineſs, and univerſal preſence. That Jeſus Chriſt is the Son of God, in whom the fulneſs of the Godhead dwells, by whom he created and governs the univerſe, exerciſing in his univerſal government the energy of the Holy Spirit, and conducting all his diſpenſations to accompliſh the deſigns of infinite wiſdom and benevolence.

The Supreme Being, though abſolutely independent and for ever ſufficient for his own beatitude, was graciouſly pleaſed to create an univerſe replete with inferior intelligences, who might for ever contemplate and enjoy his glory, participate his happineſs, and imitate his perfections. But as freedom of will is eſſential to the nature of moral agents, that they may cooperate with God in their own improvement and happineſs, ſo their natures and powers are neceſſarily limited, and by that conſtitution rendered peccable. This degeneracy firſt took place in a rank of intelligence ſuperior to man. But guilt is never ſtationary. Impatient of itſelf, and curſed with its own feelings, it proceeds from bad to worſe, whilſt the poignancy of its torments increaſes with the number of its perpetrations. Such was the ſituation of Satan, and his apoſtate angels. They attempted to transfer their turpitude and miſery to man; and were, alas! but too ſucceſsful. Hence the heterogeneous and irreconcileable principles which operate in his nature. Hence that inexplicable medley of wiſdom and folly, of rectitude and error, of benevolence and malignity, of ſincerity and fraud, exhibited through his whole conduct.

duct. Hence the darkneſs of his underſtanding, the depravity of his will, the pollution of his heart, the irregularity of his affections, and the abſolute ſubverſion of his whole internal economy. Theſe ſeeds of perdition ſoon ripened into overt acts of guilt and horror. All the hoſtilities of nature were confronted, and the whole ſublunary creation became a theatre of diſorder and miſchief.

Here the Chriſtian once more appeals to fact and experience. If theſe things are ſo; if *man* is the veſſel of guilt and the victim of miſery; he demands how this conſtitution of things can be accounted for? how can it be ſuppoſed, that a being ſo wicked and unhappy ſhould be the production of an infinitely perfect Creator? He therefore inſiſts, that human nature muſt have been diſarranged and contaminated by ſome violent ſhock; and that, of conſequence, without the light diffuſed over the face of things by Chriſtianity, all nature muſt remain an inſcrutable and inexplicable myſtery.

To redreſs theſe evils, to re-eſtabliſh the empire of virtue and happineſs, to reſtore fallen nature to its primitive rectitude, to purify from every ſtain, to remove the guilt and deſtroy the power of vice, the Son of God, the Logos or Word, the Redeemer or Saviour of the world, the Immanuel or God with us, from whom Chriſtianity takes its name, and to whom it owes its origin, deſcended from the boſom of his Father; was made fleſh; took upon him the form of a ſervant; ; endured a ſevere probation in that character; exhibited a pattern of perfect righteouſneſs; and at laſt ratified his doctrine, and fully accompliſhed all the ends of his miſſion, by a cruel, unmerited, and ignominious death. Before he left this world, he delivered the doctrine of human ſalvation, and the rules of human conduct, to his apoſtles, whom he empowered to inſtruct the world in all that concerned their eternal felicity, and whom he inveſted with miraculous gifts to aſcertain the reality of what they taught. To them he likewiſe promiſed another comforter, even the Divine Spirit, who ſhould relume the darkneſs, conſole the woes, and purify the ſtains, of human nature. Having remained for a part of three days under the power of death, he aroſe again from the grave, diſcovered himſelf to his diſciples, converſed with them for ſome time, then reaſcended to heaven; from whence the Chriſtian expects him, according to his promiſe, to appear as the Sovereign Judge of the living and the dead, from whoſe award there is no appeal, and by whoſe ſentence the pious and the wicked ſhall receive according to their deeds.

Soon after his departure to the right hand of his Father, where he ſits ſupreme of all created beings, and inveſted with the abſolute adminiſtration of heaven and earth, the Spirit of grace and conſolation deſcended on his apoſtles with viſible ſignatures of divine power and preſence. Nor were his ſalutary operations confined to them, but extended to all the rational world, who did not by obſtinate guilt repel his influences, and provoke him to withdraw them. Theſe, indeed, were leſs conſpicuous than at the glorious æra when they were viſibly exhibited in the perſons of the apoſtles. But though his energy is leſs obſervable, it is by no means leſs effectual to all the purpoſes of grace and mercy.

The Chriſtian is convinced, that there is and ſhall continue to be a ſociety upon earth, who worſhip God as revealed in Jeſus Chriſt; who believe his doctrines; who obſerve his precepts; and who ſhall be ſaved by his death, and by the uſe of theſe external means of ſalvation which he hath appointed.

13 The external means of Chriſtianity, what, and how promotive of their end.

Theſe are few and ſimple. The ſacraments of baptiſm and the euchariſt, the interpretation and application of ſcripture, the habitual exerciſe of public and private devotion, are obviouſly calculated to diffuſe and promote the intereſts of truth and virtue, by ſuperinducing the ſalutary habits of faith, love, and repentance.

The Chriſtian is firmly perſuaded, that at the period which God hath appointed, and to which the purpoſes of providence in the various revolutions of progreſſive nature tend, the whole human race ſhall once more iſſue from their graves; ſome to ſupreme felicity, in the actual perception and enjoyment of their Creator's preſence; others to that conſummate ſhame and miſery, which are the native conſequences of their wickedneſs.

14 Chriſtian morality.

The two grand principles of action, according to the Chriſtian, are, The love of God, which is the ſovereign paſſion in every perfect mind: and the love of man, which regulates our actions according to the various relations in which we ſtand, whether to communities or individuals. This ſacred connection can never be totally extinguiſhed by any temporary injury. It ought to ſubſiſt in ſome degree even amongſt enemies. It requires that we ſhould pardon the offences of others, as we expect pardon for our own; and that we ſhould no farther reſiſt evil than is neceſſary for the preſervation of perſonal rights and ſocial happineſs. It dictates every relative and reciprocal duty between parents and children, maſters and ſervants, governors and ſubjects, friends and friends, men and men. Nor does it merely enjoin the obſervation of equity, but likewiſe inſpires the moſt ſublime and extenſive charity, a boundleſs and diſintereſted effuſion of tenderneſs for the whole ſpecies, which feels their diſtreſs and operates for their relief and improvement. Theſe celeſtial diſpoſitions, and the different duties which are their natural exertions, are the various gradations by which the Chriſtian hopes to attain the perfection of his nature and the moſt exquiſite happineſs of which it is ſuſceptible.

15 This ſyſtem aſſerted by the Chriſtian, ſuperior in the excellence of its nature, and the evidence of its reality, to all others.

Such are the ſpeculative, and ſuch the practical principles of Chriſtianity. From the former, its votaries contend, that the origin, economy, and revolutions of intelligent nature alone can be rationally explained. From the latter, they aſſert, that the nature of man, whether conſidered in its individual or ſocial capacity, can alone be conducted to its higheſt perfection and happineſs. With the determined Atheiſts they ſcarcely deign to expoſtulate. For, according to them, philoſophers who can deduce the origin and conſtitution of things from caſual rencounters or mechanical neceſſity, are capable of deducing any concluſion from any premiſes. Nor can a more glaring inſtance of abſurdity be produced, than the idea of a contingent or ſelf-originated univerſe. When

Deiſts and other ſceptics upbraid them with myſterious or incompatible principles, they without heſitation deny the charge. They demand of any reaſoner who admits that a being may be omnipreſent without extenſion; or that he can impreſs motion upon other things, whilſt he himſelf is neceſſarily immoveable, upon what ground he charges Chriſtianity with incompatible principles. They aſk the ſage, why it ſhould be thought more extraordinary, that the Son of God ſhould be ſent to this world, that he ſhould be a man of like paſſions with other men, that he ſhould ſuffer and die for the relief of his degenerate creatures, than that an exiſtence whoſe felicity is eternal, inherent, and infinite, ſhould have any motive for creating beings exterior to himſelf? Is it not, ſays the Chriſtian, equally worthy of the divine interpoſition to reſtore order and happineſs where they are loſt, as to communicate them where they never have been? Is not infinite goodneſs equally conſpicuous in relieving miſery as in diffuſing happineſs? Is not the exiſtence of what we call evil in the world, under the tuition of an infinitely perfect Being, as inſcrutable as the mean exhibited by Chriſtianity for its abolition? The death and reſurrection of the Son of God, and pardon and life through him, are certainly not leſs reconcileable to human reaſon, *a priori*, than the exiſtence of vice and puniſhment in the productions of infinite wiſdom, power, and goodneſs: particularly when it is conſidered, that the virtues exerted and diſplayed by a perfect Being in a ſtate of humiliation and ſuffering, ſhall ultimately be productive of the reſtored felicity of inferior creatures, in proportion to their glory and excellence; and that ſuch goodneſs may apply the bleſſings which it has obtained, in whatever manner, in whatever degree, and to whomſoever it pleaſes, without being under any neceſſity to violate the freedom of moral agents, by recalling them to the paths of virtue and happineſs by a mechanical and irreſiſtible force.

16 Miraculous as poſſible, and perhaps as neceſſary, as natural events.

It will be granted to philoſophy by the Chriſtian, that as no theory of mechanical nature can be formed without preſuppoſing ſacred and eſtabliſhed laws from which ſhe ought rarely or never to deviate, ſo in fact ſhe tenaciouſly purſues theſe general inſtitutions, and from their conſtant obſervance reſult the order and regularity of things. But he cannot admit, that the important ends of moral and intellectual improvement may be uniformly obtained by the ſame means. He affirms, that if the hand of God ſhould either remain always entirely inviſible, or at leaſt only perceptible in the operation of ſecond cauſes, intelligent beings would be apt in the courſe of time to reſolve the interpoſitions of Deity into the general laws of mechaniſm; to forget their connection with nature, and conſequently their dependence upon him. Hence, according to the dictates of common ſenſe, and to the unanimous voice of every religion in every age or clime, for the purpoſes of wiſdom and benevolence, God may not only control, but has actually controlled, the common courſe and general operations of nature. So that, as in the material, world the law of *cauſe* and *effect* is generally and ſcrupulouſly obſerved for the purpoſes of natural ſubſiſtence and accommodation; thus ſuſpenſes and changes of that univerſal law are equally neceſſary for the advancement of moral and intellectual perfection.

17 Chriſtianity not only explains the phenomena, but conſoles the miſeries, of human nature.

But the diſciple of Jeſus not only contends, that no ſyſtem of religion has ever yet been exhibited ſo conſiſtent with itſelf, ſo congruous to philoſophy and the common ſenſe of mankind, as Chriſtianity; he likewiſe avers, that it is infinitely more productive of real and ſenſible conſolation than any other religious or philoſophical tenets, which have ever entered into the ſoul, or been applied to the heart of man. For what is death to that mind which conſiders eternity as the career of its exiſtence? What are the frowns of fortune to him who claims an eternal world as his inheritance? What is the loſs of friends to that heart which feels, with more than natural conviction, that it ſhall quickly rejoin them in a more tender, intimate, and permanent intercourſe than any of which the preſent life is ſuſceptible? What are the fluctuations and viciſſitudes of external things to a mind which ſtrongly and uniformly anticipates a ſtate of endleſs and immutable felicity? What are mortifications, diſappointments, and inſults, to a ſpirit which is conſcious of being the original offspring and adopted child of God; which knows that its omnipotent Father will, in proper time, effectually aſſert the dignity and privileges of its nature? In a word, as earth is but a ſpeck of creation, as time is not an inſtant in proportion to eternity, ſuch are the hopes and proſpects of the Chriſtian in compariſon of every ſublunary misfortune or difficulty. It is therefore, in his judgment, the eternal wonder of angels, and indelible opprobrium of man, that a religion ſo worthy of God, ſo ſuitable to the frame and circumſtances of our nature, ſo conſonant to all the dictates of reaſon, ſo friendly to the dignity and improvement of intelligent beings, pregnant with genuine comfort and delight, ſhould be rejected and deſpiſed. Were there a poſſibility of ſuſpence or heſitation between this and any other religion extant, he could freely truſt the determination of a queſtion ſo important to the candid deciſion of real virtue and impartial philoſophy.

18 Mr Gibbon attempts to prove, that the propagation of Chriſtianity was owing to cauſes from the operation of which no arguments can be deduced in proof of its authenticity.

Mr Gibbon, in his Hiſtory of the Decline and Fall of the Roman Empire, mentions five ſecondary cauſes to which he thinks the propagation of Chriſtianity, and all the remarkable circumſtances which attended it, may be with good reaſon aſcribed. He ſeems to inſinuate, that Divine Providence did not act in a ſingular or extraordinary manner in diſſeminating the religion of Jeſus through the world; and that, if every other argument which has been adduced to prove the ſacred authority of this religion can be parried or refuted, nothing can be deduced from this ſource to prevent it from ſharing the ſame fate with other ſyſtems of ſuperſtition. The cauſes of its propagation were in his opinion founded on the principles of human nature and the circumſtances of ſociety. If we aſcribe not the propagation of Mahometiſm, or of the doctrines of Zerduſt, to an extraordinary interpoſition of divine providence, operating by an unperceived influence on the diſpoſitions of the human heart, and controlling and confounding the ordinary laws of nature; neither can we, upon any reaſonable grounds, refer the promulgation of Chriſtianity to ſuch an interpoſition.

19 The cauſes. The ſecondary cauſes to which he aſcribes theſe effects are, 1. The inflexible and intolerant zeal of the Chriſtians; derived from the Jewiſh religion, but purified from the narrow and unſocial ſpirit which, inſtead of inviting, deterred the Gentiles from embracing the law of Moſes. 2. The doctrine of a future life, improved by every additional circumſtance which could give weight and efficacy to that important truth. 3. The miraculous powers aſcribed to the primitive church. 4. The pure and auſtere morals of the Chriſtians. 5. The union and diſcipline of the Chriſtian republic, which gradually formed an independant and increaſing ſtate in the heart of the Roman empire.

20 Cauſe I. In pointing out the connection between the *firſt* of theſe cauſes and the effects which he repreſents as ariſing from it, this learned and ingenious writer obſerves, that the religion of the Jews does not ſeem to have been intended to be propagated among the Heathens, and that the converſion of proſelytes was rather accidental than conſiſtent with the purport and the general ſpirit of the inſtitutions of Judaiſm. The Jews were, of conſequence, ſtudious to preſerve themſelves a peculiar people. Their zeal for their own religion was intolerant, narrow, and unſocial.

In Chriſtianity, when it made its appearance in the world, all the better part of the predominant ſpirit of Judaiſm was retained; but whatever might have a tendency to confine its influence within narrow limits was laid aſide. Chriſtians were to maintain the doctrines and adhere to the inſtitutions of their religion with ſacred fidelity. They were not to violate their allegiance to Jeſus by entertaining or profeſſing any reverence for Jupiter or any other of the Heathen deities; it was not even neceſſary for them to comply with the poſitive and ceremonial inſtitutions of the law of Moſes,—although theſe were acknowledged to have been of divine origin. The zeal, therefore, which their religion inculcated, was inflexible. It was even intolerant: for they were not to content themſelves with profeſſing Chriſtianity and conforming to its laws; they were to labour with unremitting aſſiduity, and to expoſe themſelves to every difficulty and every danger, in converting others to the ſame faith.

But the ſame circumſtances which rendered it thus intolerant, communicated to it a more liberal and a leſs unſocial ſpirit than that of Judaiſm. The religion of the Jews was intended only for a few tribes: Chriſtianity was to become a catholic religion; its advantages were to be offered to all mankind.

All the different ſects which aroſe among the primitive Chriſtians uniformly maintained the ſame zeal for the propagation of their own religion, and the ſame abhorrence for every other. The Orthodox, the Ebionites, the Gnoſtics, were all equally animated with the ſame excluſive zeal, and the ſame abhorrence of idolatry, which had diſtinguiſhed the Jews from other nations.

21 Obſervations in anſwer. Such is the general purport of what Mr Gibbon advances concerning the influence of the firſt of thoſe ſecondary cauſes in the propagation of Chriſtianity. It would be uncandid to deny, that his ſtatement of facts appears to be, in this inſtance, almoſt fair, and his deductions tolerably logical. The firſt Chriſtians *were* remarkable for their deteſtation of idolatry, and for the generous diſintereſted zeal with which they laboured to convert others to the ſame faith. The firſt of theſe principles, no doubt, contributed to maintain the dignity and the purity of Chriſtianity; and the ſecond to diſſeminate it through the world. But the facts which he relates are ſcarce conſiſtent throughout. He ſeems to repreſent the zeal of the firſt Chriſtians as ſo hot and intolerant, that they could have no ſocial intercourſe with thoſe who ſtill adhered to the worſhip of Heathen deities. In this caſe, how could they propagate their religion? Nay, we may even aſk, How could they live? If they could not mingle with the Heathens in the tranſactions either of peace or war; nor witneſs the marriage or the funeral of the deareſt friend, if a Heathen; nor practiſe the elegant arts of muſic, painting, eloquence, or poetry; nor venture to uſe freely in converſation the language of Greece or of Rome:—it is not eaſy to ſee what opportunities they could have of diſſeminating their religious ſentiments. If, in ſuch circumſtances, and obſerving rigidly ſuch a tenor of conduct, they were yet able to propagate their religion with ſuch amazing ſucceſs as they are ſaid to have done; they muſt ſurely either have practiſed ſome wondrous arts unknown to us, or have been aſſiſted by the ſupernatural operation of divine power.

But all the hiſtorical records of that period, whether ſacred or profane, concur to prove, that the primitive Chriſtians in general did not retire with ſuch religious horror from all intercourſe with the Heathens. They refuſed not to ſerve in the armies of the Roman empire: They appealed to Heathen magiſtrates, and ſubmitted reſpectfully to their deciſions: the Huſband was often a Heathen, and the wife a Chriſtian; or, again, the huſband a Chriſtian, and the wife a Heathen. Theſe are facts ſo univerſally known and believed, that we need not quote authorities in proof of them.

This reſpectable writer appears therefore not to have ſtated the facts which he produces under this head with ſufficient ingenuouſneſs; and he has taken care to exaggerate and improve thoſe which he thinks uſeful to his purpoſe with all the dazzling, deluſive colours of eloquence. But had the zeal of the firſt Chriſtians been ſo intolerant as he repreſents it, it muſt have been highly unfavourable to the propagation of their religion: all their wiſhes to make converts would, in that caſe, have been counteracted by their unwillingneſs to mix, in the ordinary intercourſe of life, with thoſe who were to be converted. Their zeal, and the liberal ſpirit of their religion, were indeed ſecondary cauſes which contributed to its propagation: but their zeal was by no means ſo ridiculouſly intolerant as this writer would have us believe; if it had, it muſt have produced effects directly oppoſite to thoſe which he aſcribes to it.

22 Cauſe II. In illuſtrating the influence of the *Second* of theſe ſecondary cauſes to which he aſcribes the propagation of Chriſtianity, Mr Gibbon diſplays no leſs ingenuity than in tracing the nature and the effects of the firſt. The doctrine of a future life, improved by every additional circumſtance which can give weight and efficacy to that important truth, makes a conſpicuous figure in the Chriſtian ſyſtem; and it is a doctrine highly flattering to the natural hopes and wiſhes of the human heart.

Though the Heathen philoſophers were not unacquainted with this doctrine; yet to them the ſpirituality of the human ſoul, its capacity of exiſtence in a ſeparate ſtate from the body, its immortality, and its proſpect of laſting happineſs in a future life, rather appeared things poſſible and deſirable, than truths fully eſtabliſhed upon ſolid grounds. Theſe doctrines, Mr Gibbon would perſuade us, had no influence on the moral ſentiments and general conduct of the Heathens. Even the philoſophers, who amuſed themſelves with diſplaying their eloquence and ingenuity on thoſe ſplendid themes, did not allow them to influence the tenor of their lives. The great body of the people, who were occupied in purſuits very different from the ſpeculations of philoſophy, and were unacquainted with the queſtions diſcuſſed in the ſchools, were ſcarce ever at pains to reflect whether they conſiſted of a material and a ſpiritual part, or whether their exiſtence was to be prolonged beyond the term of the preſent life; and they could not regulate their lives by principles which they did not know.

In the popular ſuperſtition of the Greeks and Romans, the doctrine of a future ſtate was not omitted. Mankind were not only flattered with the hopes of continuing to exiſt beyond the term of the preſent life; but different conditions of exiſtence were promiſed or threatened, in which retributions for their conduct in human life were to be enjoyed or ſuffered. Some were exalted to heaven, and aſſociated with the gods; others were rewarded with leſs illuſtrious honours, and a more moderate ſtate of happineſs, in Elyſium; and thoſe, again, who by their conduct in life had not merited rewards, but puniſhments, were conſigned to Tartarus. Such were the ideas of a future ſtate which made a part of the popular ſuperſtition of the Greeks and Romans. But they produced only a very faint impreſſion on the minds of thoſe among whom they prevailed. They were not truths ſupported by evidence; they were not even plauſible; they were a tiſſue of abſurdities. They had not therefore a more powerful influence on the morals, than the more refined ſpeculations of the philoſophers.

Even the Jews, whoſe religion and legiſlature were communicated from heaven, were in general, till within a very ſhort time before the propagation of the goſpel, as imperfectly acquainted with the doctrine of a future ſtate as the Greeks and Romans. This doctrine made no part of the law of Moſes. It is but darkly and doubtfully inſinuated through the other parts of the Old Teſtament. Thoſe among the Jews who treated the ſacred ſcriptures with the higheſt reverence, always denied that ſuch a doctrine could be deduced from any thing which theſe taught; and maintained that death is the final diſſolution of man.

The rude tribes who inhabited ancient Gaul, and ſome other nations not more civilized than they, entertained ideas of a future life, much clearer than thoſe of the Greeks, the Romans, or the Jews.

Chriſtianity, however, explained and inculcated the truth of this doctrine in all its ſplendor and all its dignity. It exhibited an alluring, yet not abſurd, view of the happineſs of a future life. It conferred new horrors on the place of puniſhment, and added new ſeverity to the tortures to be inflicted, in another world. The authority on which it taught theſe doctrines, and diſplayed theſe views, was ſuch as to ſilence inquiry and doubt, and to command implicit belief. What added to the influence of the doctrine of a future ſtate of exiſtence, thus explained and inculcated, was, that the firſt Chriſtians confidently propheſied and ſincerely believed that the end of the world, the conſummation of all things, was faſt approaching, and that the generation then preſent ſhould live to witneſs that awful event. Another circumſtance which contributed to render the ſame doctrine ſo favourable to the propagation of Chriſtianity was, that the firſt Chriſtians dealt damnation without remorſe, and almoſt without making any exceptions, on all who died in the belief of the abſurdities of Heathen ſuperſtition. Thus taught and improved with theſe additional and heightening circumſtances, this doctrine, partly by preſenting alluring proſpects and exciting pleaſing hopes, partly by working upon the fears of the human heart with repreſentations of terror, operated in the moſt powerful manner in extending the influence of the Chriſtian faith.

23 Obſervations in anſwer.

Here, too, facts are rather exaggerated, and the inferences ſcarce fairly deduced. It muſt be confeſſed, that the ſpeculations of the Heathen philoſophers did not fully and undeniably eſtabliſh the doctrine of the immortality of the human ſoul; nor can we preſume to aſſert, in contradiction to Mr Gibbon, that their arguments could impreſs ſuch a conviction of this truth as might influence in a very ſtrong degree the moral ſentiments and conduct. They muſt, however, have produced ſome influence on theſe. Some of the moſt illuſtrious among the Heathen philoſophers appear to have been ſo ſtrongly impreſſed with the belief of the ſoul's immortality, and of a future ſtate of retribution, that their general conduct was conſtantly and in a high degree influenced by that belief. Plato and Socrates are eminent and well known inſtances. And if, in ſuch inſtances as theſe, the belief of theſe truths produced ſuch conſpicuous effects; it might be fairly inferred, though we had no farther evidence, that thoſe characters were far from being ſingular in this reſpect. It is a truth acknowledged as unqueſtionable in the hiſtory of the arts and ſciences, that wherever any one perſon has cultivated theſe with extraordinary ſucceſs, ſome among his contemporaries will always be found to have rivalled his excellence, and a number of them to have been engaged in the ſame purſuits. On this occaſion we may venture, without heſitation, to reaſon upon the ſame principles. When the belief of the immortality of the human ſoul produced ſuch illuſtrious patterns of virtue as a Plato and a Socrates; it muſt certainly have influenced the moral ſentiments and conduct of many others,—although in an inferior degree. We ſpeculate, we doubt, concerning the truth of many doctrines of Chriſtianity, many who profeſs that they believe them, make this profeſſion only becauſe they have never conſidered ſeriouſly whether they be true or falſe. But, notwithſtanding this, theſe truths ſtill exert a powerful influence on the ſentiments and manners of ſociety in general. Thus, alſo, it appears, that the doctrines of ancient philoſophy concerning a future life, and even the notions concerning Olympus, Elyſium, and Tartarus, which made a part of the popular ſuperſtition, *did* produce a certain influence on the ſentiments and manners of the heathens in general. That influence was often indeed inconſiderable, and not always happy; but ſtill it was ſomewhat greater than Mr Gibbon ſeems willing to allow. Chriſtians have been ſometimes at pains to exaggerate the abſurdities of Pagan ſuperſtition, in order that the advantages of Chriſtianity might acquire new value from being contraſted with it. Here we find one who is rather diſpoſed to be the enemy of Chriſtianity, diſplaying, and even exaggerating, thoſe abſurdities for a very different purpoſe. But the truth may be ſafely admitted: it is only when exaggerated that it can ſerve any purpoſe inimical to the ſacred authority of our holy religion. Mr Gibbon certainly repreſents the religious doctrine of the ancient Gauls, in reſpect to the immortality of the human ſoul and a future ſtate, in too favourable a light. It is only becauſe the whole ſyſtem of ſuperſtition which prevailed among thoſe barbarians is ſo imperfectly known, that it has been imagined to conſiſt of more ſublime doctrines than thoſe of the popular ſuperſtition of the Greeks and Romans. The evidence which Mr Gibbon adduces in proof of what he aſſerts concerning theſe opinions of the ancient Gauls, is partial, and far from ſatisfactory. They *did* indeed aſſert and believe the ſoul to be immortal; but this doctrine was blended among a number of abſurdities much groſſer than thoſe which characteriſe the popular religion of the Greeks and Romans. The latter was the ſuperſtition of a civilized people, among whom reaſon was unfolded and improved by cultivation, and whoſe manners were poliſhed and liberal; the former was that of barbarians, among whom reaſon was, as it were, in its infancy, and who were ſtrangers to the improvements of civilization. When haſty obſervers found that thoſe barbarians were not abſolutely ſtrangers to the idea of immortality, they were moved to undue admiration; their ſurpriſe at finding what they had not expected, confounded their underſtanding, and led them to miſconceive and miſrepreſent. What we ought to aſcribe to the ſavage ferocity of the character of thoſe rude tribes, has been attributed by miſtake to the influence of their belief of a future ſtate.

In the law of Moſes, it muſt be allowed, that this doctrine is not particularly explained nor earneſtly inculcated. The author of the Divine Legation of Moſes, &c. has founded upon this fact an ingenious theory, which we ſhall elſewhere have occaſion to examine. The reaſons why this doctrine was not more fully explained to the Jews, we cannot pretend to aſſign, at leaſt in this place; yet we cannot help thinking, that it was more generally known among the Jews than Mr Gibbon and the author of the Divine Legation are willing to allow. Though it be not ſtrongly inculcated in their *code of laws*, yet there is ſome reaſon to think that it was known and generally prevalent among them long before the Babyloniſh captivity; even in different paſſages in the writings of Moſes, it is mentioned or alluded to in an unequivocal manner. In the hiſtory of the patriarchs, it appears that this doctrine was known to *them*; it appears to have had a ſtrong influence on the mind of Moſes himſelf. Was David, was Soloman, a ſtranger to this doctrine? We cannot here deſcend to very minute particulars; but ſurely all the efforts of ingenuity muſt be inſufficient to torture the ſacred ſcriptures of the Old Teſtament, ſo as to prove that they contain nothing concerning the doctrine of a future ſtate any where but in the writings of the latter prophets, and that even in theſe it is only darkly inſinuated. Were the Jews, in the earlier part of their hiſtory, ſo totally ſecluded from all intercourſe with other nations, that a doctrine of ſo much importance, more or leſs known to all around, could not be communicated to them? The Phariſees *did* admit traditions, and ſet upon them an undue value; yet they appear to have been conſidered as the moſt orthodox of the different ſects which prevailed among the Jews: the Sadducees were rather regarded as innovators.

But though we are of opinion, that this ingenious writer allows to the doctrine of the Greek and Roman philoſophers, concerning the immortality of the human ſoul, as well as to the notions concerning a future ſtate which made a part of the popular ſuperſtitions of thoſe nations, leſs influence on the moral ſentiments and conduct of mankind than what they really exerted; though we cannot agree with him in allowing the ideas of the immortality of the ſoul and of a future ſtate, which were entertained by the Gauls and ſome other rude nations, to have been much ſuperior in their nature, or much happier in their influence, than thoſe of the Greeks and Romans; and though, in conſequence of reading the Old teſtament, we are diſpoſed to think that the Jews knew ſomewhat more concerning the immortality of the human ſoul, and concerning the future ſtate in which human beings are diſtined to exiſt, than Mr Gibbon repreſents them to have known; yet ſtill we are very ſenſible, and very well pleaſed to admit, that "life and immortality were brought to light through the goſpel."

The doctrine of a future life, as it was preached by the firſt Chriſtians, was eſtabliſhed on a more ſolid baſis than that on which it had been before maintained; was freed from every abſurdity; and was, in ſhort, ſo much improved, that its influence, which, as it was explained by Heathen poets and philoſophers, muſt be confeſſed to have been in many inſtances doubtful, now became favourable only to the intereſts of piety and virtue, and to them in a very high degree. It undoubtedly contributed to the ſucceſsful propagation of Chriſtianity; for it was calculated to attract and pleaſe both the ſpeculating philoſopher and the ſimple unenlightened votary of the vulgar ſuperſtition. The views which it exhibited were diſtinct; and all was plauſible and rational, and demonſtrated by the fulleſt evidence. But the happineſs which it promiſed was of a leſs ſenſual nature than the enjoyments which the Heathens expected on Olympus or in Elyſium; and would therefore appear leſs alluring to thoſe who were not very capable of refined ideas, or preferred the gratification of the ſenſes in the preſent life to every other ſpecies of good. If the firſt Chriſtians rejoiced in the hope of beholding all the votaries of Pagan idolatry afflicted with the torments of hell in a future ſtate, and boaſted of theſe hopes with inhuman exultation, they would in all probability rather irritate than alarm thoſe whom they ſought to convert from that ſuperſtition: the Heathens would be moved to regard with indignant ſcorn the preacher who pretended, that thoſe whom they venerated as gods, heroes, and wiſe men, were condemned to a ſtate of unſpeakable and laſting torment. Would not every feeling of the heart revolt againſt the idea, that a parent, a child, a huſband, a wife, a friend, a lover, or a miſtreſs, but lately loſt, and ſtill lamented, was conſigned to eternal torments for actions and opinions which they had deemed highly agreeable to ſuperior powers?

We may conclude, then, with reſpect to the influence of this ſecondary cauſe in promoting the propagation of Chriſtianity, that the circumſtances of the Heathen world was leſs favourable to that influence than Mr Gibbon pretends; that the means by which he repreſents the primitive Chriſtians, as improving its efficacy, were ſome of them not employed, and others rather likely to weaken than to ſtrengthen it; and that therefore more is attributed to the operation of this cauſe than it could poſſibly produce.

Cauſe III.

The *third cauſe*, the miraculous powers of the primitive church, is with good reaſon repreſented as having conduced very often to the conviction of infidels. Mr Gibbon's reaſonings under this head are, That numerous miraculous works of the moſt extraordinary kind were oſtentatiouſly performed by the firſt Chriſtians: that, however, from the difficulty of fixing the period at which miraculous powers ceaſed to be communicated to the Chriſtian church, and from ſome other circumſtances, there is reaſon to ſuſpect them to have been merely the pretences of impoſture; but this (to uſe a phraſe of his own) is only darkly inſinuated: and laſtly, that the Heathens having been happily prepared to receive them as real by the many wonders nearly of a ſimilar nature to which they were accuſtomed in their former ſuperſtition, the miracles which the firſt Chriſtians employed to give a ſanction to their doctrines, contributed in the moſt effectual manner to the propagation of Chriſtianity.

Obſervations in reply.

In reply to what is here advanced, it may be ſuggeſted, that the miracles recorded in the New Teſtament, as having been performed by the firſt Chriſtians when engaged in propagating their religion, as well as a number of others recorded by the Fathers, are eſtabliſhed as true, upon the moſt indubitable evidence which human teſtimony can afford for any fact. An ingenious Scotch writer *, who was ſo fond of employing his ingenuity in undermining truths generally received, has endeavoured to prove that no human teſtimony, however ſtrong and unexceptionable, can afford ſufficient evidence of the reality of a miracle. But his reaſonings on this head, which once excited doubt and wonder, have been ſince completely refuted; and mankind ſtill continue to acknowledge, that though we are all liable to miſtakes and capable of deceit, yet human teſtimony *may* afford the moſt convincing evidence of the moſt extraordinary and even ſupernatural facts. The reader will not expect us to enter, in this place, into a particular examination of the miracles of our Saviour, and his apoſtles, and the primitive church. An enquiry into theſe will be a capital object in another part of this work (THEOLOGY). We may here conſider it as an undeniable and a generally acknowledged fact, that a certain part of thoſe miracles were real. Such as were real, undoubtedly contributed, in a very eminent manner, to the propagation of Chriſtianity; but they are not to be ranked among the natural and *ſecondary* cauſes.

It is difficult to diſtinguiſh at what period miraculous gifts ceaſed to be conferred on the members of the primitive church; yet we *may* diſtinguiſh, if we take pains to inquire with minute attention, at what period the evidence ceaſes to be ſatisfactory. We can alſo by conſidering the circumſtances of the church through the ſeveral ſtages of its hiſtory, form ſome judgment concerning the period during which the gifts of propheſying, and ſpeaking with tongues, and working miracles, were moſt neceſſary to Chriſtians to enable them to aſſert the truth and dignity of their religion.

The Heathens were no ſtrangers to pretended miracles and prophecies, and other ſeeming interpoſitions of ſuperior beings, diſturbing the ordinary courſe of nature and of human affairs: but the miracles to which they were familiariſed had been ſo often detected to be tricks of impoſture or pretences of mad enthuſiaſm, that, inſtead of being prepared to witneſs or to receive accounts of new miracles with eaſy credulity, they muſt have been in general diſpoſed to view them with jealouſy and ſuſpicion. Beſides, the miracles to which they had been accuſtomed, and thoſe performed by the apoſtles and the firſt preachers of Chriſtianity, were directly contradictory; and therefore the one could receive no aſſiſtance from the other.

Yet we muſt acknowledge, notwithſtanding what we have above advanced, that as diſagreements with reſpect to the principles and inſtitutions of their religion very early aroſe among Chriſtians; ſo they likewiſe ſought to extend its influence, at a very early period, by the uſe of *pious frauds*. Pious frauds, too, appear to have ſometimes ſerved the immediate purpoſes for which they were employed, though eventually they have been highly injurious to the cauſe of Chriſtianity.

We conclude, then, that Chriſtianity *was* indebted to the influence of miracles in a conſiderable degree for its propagation: but that the real miracles of our Saviour and his apoſtles, &c. were not among the *ſecondary* cauſes of its ſucceſs: that the Heathens who were to be converted were not very happily prepared for receiving the miracles of the goſpel with blind credulity: that, as it is poſſible to diſcern between ſufficient and inſufficient evidence, ſo it is not more difficult to diſtinguiſh between true and falſe miracles: and, laſtly, that falſe miracles were ſoon employed by Chriſtians as engines to ſupport and propagate their religion, and perhaps not unſucceſsfully; but were, upon the whole, more injurious than ſerviceable to the cauſe which they were called in to maintain.

Cauſe IV.

The *fourth of this ſeries of ſecondary cauſes*, which this author thinks to have been adequate to the propagation of Chriſtianity, is the virtues of the primitive Chriſtians. Theſe he is willing to attribute to other and leſs generous motives, rather than to the pure influence of the doctrines and precepts of their religion.

The firſt converts to Chriſtianity were moſt of them from among the loweſt and moſt worthleſs characters. The wiſe, the mighty, and thoſe who were diſtinguiſhed by ſpecious virtues, were in general perfectly ſatisfied with theeir preſent circumſtances and future proſpects. People whoſe minds were naturally weak, unenlightened, or oppreſſed with the ſenſe of atrocious guilt, and who were infamous or outcaſts from ſociety, were eager to graſp at the hopes which the goſpel held out to them.

When, after enliſting under the banner of Chriſt, they began to conſider themſelves as "born again to newneſs of life; remorſe and fear, which eaſily prevail over weak minds; ſelfiſh hopes of regaining their reputation, and attaining to the honours and happineſs of thoſe manſions which Jeſus was ſaid to have gone to prepare; with a deſire to raiſe the honour and extend the influence of the ſociety of which they were become members; all together operated ſo powerfully as to enable them to diſplay both active and paſſive virtue in a very extraordinary degree. Their virtues did not flow from the pureſt and nobleſt ſource; yet they attracted the notice and moved the admiration of mankind. Of thoſe who admired, ſome were eager to imitate; and, in order to that, thought it neceſſary to adopt the ſame principles of action.

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* Mr *Hume*.

Their virtues too, were rather of that ſpecies which excite wonder, becauſe uncommon, and not of eſſential utility in the ordinary intercourſe of ſociety; than of thoſe which are indiſpenſably neceſſary to the exiſtence of ſocial order, and contribute to the eaſe and convenience of life. Such virtues were well calculated to engage the imitation of thoſe who had failed egregiouſly in the practice of the more ſocial virtues.

Thus they practiſed extraordinary, but uſeleſs and unſocial, virtues, upon no very generous motives; and thoſe virtues drew upon them the eyes of the world, and induced numbers to embrace their faith.

Obſervations, in anſwer.

We muſt, however unwillingly, declare, that this is plainly an uncandid account of the virtues of the primitive Chriſtians, and the motives from which they originated. The ſocial virtues are ſtrongly recommended through the goſpel. No degree of mortification or ſelf-denial, or ſecluſion from the ordinary buſineſs and amuſements of ſocial life, was required of the early converts to Chriſtianity; ſave what was indiſpenſably neceſſary to wean them from the irregular habits in which they had before indulged, and which had rendered them nuiſances in ſociety, and to form them to new habits equally neceſſary to their happineſs and their uſefulneſs in life. We allow that they practiſed virtues which in other circumſtances would, however ſplendid, have been unneceſſary. But in the difficult circumſtances in which the firſt Chriſtians were placed, the virtues which they practiſed were in the higheſt degree ſocial. The moſt prominent feature in their character was, "their continuing to entertain ſentiments of generous benevolence, and to diſcharge ſcrupulouſly all the ſocial duties," towards thoſe who exerciſed neither charity nor humanity, and frequently not even bare integrity and juſtice, in their conduct towards them.

It cannot be ſaid with truth, that ſuch a proportion of the primitive Chriſtian were people whoſe characters had been infamous and their circumſtances deſperate, as that the character of the religion which they embraced can ſuffer from this circumſtance. Nor were they *only* the weak and illiterate whom the apoſtles and their immediate ſucceſſors converted by their preaching. The criminal, to be ſure, rejoiced to hear that he might obtain abſolution of his crimes; the mourner was willing to receive comfort; minds of refined and generous feelings were deeply affected with that goodneſs which had induced the Son of God to ſubmit to ſuffer and die for ſinners: but the ſimplicity, the rationality, and the beauty of the Chriſtian ſyſtem, likewiſe prevailed in numerous inſtances over the pride and prejudices of the great and the wiſe; in ſo many inſtances, as are ſufficient to vindicate the Chriſtian church from the aſperſion by which it has been repreſented, as being in the firſt period of its exiſtence merely a body of *criminals and idiots*.

The principles, too, from which the virtues of the firſt Chriſtians originated, were not peculiarly mean and ſelfiſh; nay, they ſeem to have been uncommonly ſublime and diſintereſted. Remorſe in the guilty mind is a natural and reaſonable ſentiment; the deſire of happineſs in every human breaſt is equally ſo. It is uncandid to cavil againſt the firſt Chriſtians for being, like the reſt of mankind, influenced by theſe ſentiments: And when we behold them overlooking temporary poſſeſſions and enjoyments, extending their views to futurity, and "living by faith;" when we obſerve them "doing good to thoſe who hated them, bleſſing thoſe who curſed them, and praying for thoſe by whom they were deſpitefully uſed;" can we deny their virtues to have been of the moſt generous and diſintereſted kind?

We allow, then, that the virtues of the firſt Chriſtians muſt have contributed to the propagation of their religion: but it is with pain that we obſerve this reſpectable writer ſtudiouſly labouring to miſrepreſent the principles from which thoſe virtues aroſe; and not only the principles from which they aroſe, but alſo their importance in ſociety.

Cauſe V. with obſervations.

The *fifth cauſe* was the mode of church government adopted by the firſt Chriſtians, by which they were knit together in one ſociety; who preferred the church and its intereſts to their country and civil concerns. We wiſh not to deny, that the mutual attachment of the primitive Chriſtians contributed to ſpread the influence of their religion; and the order which they maintained, in conſequence of being animated with this ſpirit of brotherly love, and with ſuch ardent zeal for the glory of God, muſt no doubt have produced no leſs happy effects among them than order and regularity produce on every other occaſion on which they are ſtrictly obſerved. But whether the form of church-government, which was gradually eſtabliſhed in the Chriſtian church, was actually the happieſt that could poſſibly have been adopted; or whether, by eſtabliſhing a diſtinct ſociety, with ſeparate intereſts, within the Roman empire, it contributed to the diſſolution of that mighty fabric, we cannot here pretend to inquire. Theſe are ſubjects of diſcuſſion, with reſpect to which we may with more propriety endeavour to ſatisfy our readers elſewhere.

General concluſion concerning the influence of the five cauſes.

From the whole of this review of what Mr Gibbon has ſo ſpeciouſly advanced concerning the influence of theſe five ſecondary cauſes in the propagation of the goſpel, we think ourſelves warranted to conclude, That the zeal of the firſt Chriſtians was not, as he repreſents it, intolerant: That the doctrine of the immortality of the human ſoul was ſomewhat better underſtood in the heathen world, particularly among the Greeks and Romans and the Jews, than he repreſents it to have been; and had an influence ſomewhat happier than what he aſcribes to it: That the additional circumſtances by which, he tells us, the firſt preachers of Chriſtianity improved the effects of this doctrine, were far from being calculated to allure converts: That the heathens, therefore, were not quite ſo well prepared for an eager reception of this doctrine as he would perſuade us they were; and, of conſequence, could not be influenced by it in ſo conſiderable a degree, in their converſion: That real, unqueſtionable miracles, performed by our Saviour, by his apoſtles, and by their ſucceſſors, *did* contribute ſignally to the propagation of Chriſtianity; but are not to be ranked among the *ſecondary* cauſes: That weakneſs and blind zeal did at times employ pretended miracles for the ſame purpoſe not altogether ineffectually: That though theſe deſpicable and wicked means might be in ſome inſtances ſucceſsful; yet they were, upon the whole, much more injurious than beneficial: That the virtues of the primitive Chriſtians aroſe from the moſt generous and noble motives, and were in their nature and tendency highly favourable to ſocial order, and to the comfort of mankind in the ſocial ſtate: And, laſtly, That the order and regularity of church-government, which were gradually eſtabliſhed among the firſt Chriſtians, contributed greatly to maintain the dignity and ſpread the influence of their religion; but do not appear to have disjoined them from their fellow-ſubjects or to have rendered them inimical to the welfare of the ſtate of which they were members.

Upon the whole, then, we do not ſee that theſe ſecondary cauſes were equal to the effects that have been aſcribed to them; and it ſeems undeniable, that others of a ſuperior kind co-operated with them. We earneſtly recommend to the peruſal of the reader a valuable performance of Lord Hailes's, in which he enquires into Mr Gibbon's aſſertions and reaſonings, concerning the influence of theſe five cauſes, with the utmoſt accuracy of information, ſtrength and clearneſs of reaſoning, and elegant ſimplicity of ſtyle, and without virulence or paſſion.

CHRISTIANS, thoſe who profeſs the religion of Chriſt: See CHRISTIANITY and MESSIAH.—The name *Chriſtian* was firſt given at Antioch in the year 42 to ſuch as believed in Chriſt, as we read in the Acts: till that time they were called *diſciples*.

The firſt Chriſtians diſtinguiſhed themſelves in the moſt remarkable manner by their conduct and their virtues. The faithful, whom the preaching of St Peter had converted, hearkened attentively to the exhortations of the Apoſtles, who failed not carefully to inſtruct them, as perſons who were entering upon an entirely new life. They went every day to the temple with one heart and one mind, and continued in prayers; doing nothing different from the other Jews, becauſe it was yet not time to ſeparate from them. But they made a ſtill greater progreſs in virtue; for they ſold all that they poſſeſſed, and diſtributed their goods in proportion to the wants of their brethren. They *eat their meat with gladneſs and ſingleneſs of heart, praiſing God, and having favour with all the people.* St Chryſoſtom, examining from what ſource the eminent virtue of the firſt Chriſtians flowed, aſcribes it principally to their diveſting themſelves of their poſſeſſions; "For (ſays that father) perſons from whom all that they have is taken away, are not ſubject to ſin: whereas, whoever has large poſſeſſions, wants not a devil or a tempter to draw him into hell by a thouſand ways."

The Jews were the firſt and the moſt inveterate enemies the Chriſtians had. They put them to death as often as they had it in their power: and when they revolted againſt the Romans in the time of the emperor Adrian, Barchochebas, the head of that revolt, employed againſt the Chriſtians the moſt rigorous puniſhments to compel them to blaſpheme and renounce Jeſus Chriſt. And we find that, even in the third century, they endeavoured to get into their hands Chriſtian women, in order to ſcourge and ſtone them in their ſynagogues. They curſed the Chriſtians ſolemnly three times a-day in their ſynagogues, and their rabbins would not ſuffer them to converſe with Chriſtians upon any occaſion. Nor were they contented to hate and deteſt them; but they diſpatched emiſſaries all over the world to defame the Chriſtians, and ſpread all ſorts of calumnies againſt them. They accuſed them, among other things, of worſhipping the ſun and the head of an aſs. They reproached them with idleneſs, and being an uſeleſs race of people. They charged them with treaſon, and endeavouring to erect a new monarchy againſt that of the Romans. They affirmed, that, in celebrating their myſteries, they uſed to kill a child and eat its fleſh. They accuſed them of the moſt ſhocking inceſts, and of intemperance in their feaſts of charity. But the lives and behaviour of the firſt Chriſtians were ſufficient to refute all that was ſaid againſt them, and evidently demonſtrated that theſe accuſations were mere calumny and the effect of inveterate malice.

Pliny the younger, who was governor of Pontus and Bithynia between the years 103 and 105, gives a very particular account of the Chriſtians in that province, in a letter which he wrote to the emperor Trajan, of which the following is an extract: "I take the liberty, Sir, to give you an account of every difficulty which ariſes to me. I have never been preſent at the examination of the Chriſtians; for which reaſon I know not what queſtions have been put to them, nor in what manner they have been puniſhed. My behaviour towards thoſe who have been accuſed to me has been this: I have interrogated them, in order to know whether they were really Chriſtians. When they have confeſſed it, I have repeated the ſame queſtion two or three times, threatening them with death if they did not renounce this religion. Thoſe who have perſiſted in their confeſſion, have been, by my order, led to puniſhment. I have even met with ſome Roman citizens guilty of this phrenſy, whom, in regard to their quality, I have ſet apart from the reſt, in order to ſend them to Rome. Theſe perſons declare, that their whole crime, if they are guilty, conſiſts in this; that, on certain days, they aſſemble before ſun-riſe, to ſing alternately the praiſes of Chriſt, as of a God, and to oblige themſelves, by the performance of their religious rites, not to be guilty of theft, or adultery, to obſerve inviolably their word, and to be true to their truſt. This depoſition has obliged me to endeavour to inform myſelf ſtill farther of this matter, by putting to the torture two of their women-ſervants, whom they call *deaconeſſes*: but I could learn nothing more from them, than that the ſuperſtition of theſe people is as ridiculous as their attachment to it is aſtoniſhing."

There is extant a juſtification, or rather panegyric, of the Chriſtians, pronounced by the mouth of a Pagan prince. It is a letter of the emperor Antoninus, written in the year 152, in anſwer to the States of Aſia, who had accuſed the Chriſtians of being the cauſe of ſome earthquakes which had happened in that part of the world. The emperor adviſes them to "take care, leſt, in torturing and puniſhing thoſe whom they accuſed of Atheiſm (meaning the Chriſtians), they ſhould render them more obſtinate, inſtead of prevailing upon them to change their opinion; ſince their religion taught them to ſuffer with pleaſure for the ſake of God." As to the earthquakes which had happened, he puts them in mind," that they themſelves are always diſcouraged, and ſink under ſuch misfortunes; whereas the Chriſtians never diſcovered more cheerfulneſs and confidence in God than upon ſuch occaſions." He tells them, that "they pay no regard to religion, neglect the worſhip of the Eternal; and, becauſe the Chriſtians honour and adore Him, therefore they are jealous of them, and perſecute them even to death." He concludes: "Many of the governors of provinces have formerly written to my father concerning them; and his anſwer always was, that they ſhould not be moleſted or diſturbed, provided they quietly ſubmitted to the authority of the government. Many perſons have likewiſe conſulted me upon this affair, and I have returned the ſame anſwer to them all; namely, that if any one accuſes a Chriſtian merely on account of his religion, the accuſed perſon ſhall be acquitted, and the accuſer himſelf puniſhed." This ordinance, according to Euſebius, was publicly fixed up at Epheſus in an aſſembly of the ſtates.

It is no difficult matter to diſcover the cauſes of the many perſecutions, to which the Chriſtians were expoſed during the three firſt centuries. The purity of the Chriſtian morality, directly oppoſite to the corruption of the Pagans, was doubtleſs one of the moſt powerful motives of the public averſion. To this may be added, the many calumnies unjuſtly ſpread about concerning them by their enemies, particularly the Jews. And this occaſioned ſo ſtrong a prejudice againſt them, that the Pagans condemned them without inquiring into their doctrine, or permitting them to defend themſelves. Beſides, their worſhipping Jeſus Chriſt, as God, was contrary to one of the moſt ancient laws of the Roman empire, which expreſsly forbad the acknowledging of any God which had not been approved by the ſenate.

But notwithſtanding the violent oppoſition made to the eſtabliſhment of the Chriſtian religion, it gained ground daily, and very ſoon made a ſurpriſing progreſs in the Roman empire. In the third century, there were Chriſtians in the camp, in the ſenate, in the palace; in ſhort every where, but in the temples and the theatres: they filled the towns, the country, the iſlands. Men and women, of all ages and conditions, and even thoſe of the firſt dignities, embraced the faith; inſomuch that the Pagans complained that the revenues of their temples were ruined. They were in ſuch great numbers in the empire, that (as Tertullian expreſſes it) were they to have retired into another country, they would have left the Romans only a frightful ſolitude.

The primitive Chriſtians were not only remarkable for the practice of every virtue; they were alſo very eminently diſtinguiſhed by the many miraculous gifts and graces beſtowed by God upon them. "Some of the Chriſtians (ſays Irenæus) drive out devils, not in appearance only, but ſo as that they never return; whence it often happens, that thoſe who are diſpoſſeſſed of evil ſpirits embrace the faith and are received into the church. Others know what is to come, ſee viſions, and deliver oracles as prophets. Others heal the ſick by laying their hands on them, and reſtore them to perfect health: and we find ſome who even raiſe the dead.——It is impoſſible to reckon up the gifts and graces which the church has received from God—what they have freely received they as freely beſtow. They obtain theſe gifts by prayer alone, and invocation, of the name of Jeſus Chriſt, without any mixture of enchantment or ſuperſtition."

We ſhall here ſubjoin the remarkable ſtory, atteſted by Pagan authors themſelves, concerning the *Chriſtian Legion* in the army of the emperor Marcus Aurelius. That prince having led his forces againſt the Quadi, a people on the other ſide of the Danube, was ſurrounded and hemmed in by the enemy in a diſadvantageous place, and where they could find no water. The Romans were greatly embarraſſed, and, being preſſed by the enemy, were obliged to continue under arms, expoſed to the violent heat of the ſun, and almoſt dead with thirſt; when, on a ſudden, the clouds gathered, and the rain fell in great abundance. The ſoldiers received the water in their bucklers and helmets, and ſatisfied both their own thirſt and that of their horſes. The enemy, preſently after, attacked them; and ſo great was the advantage they had over them, that the Romans muſt have been overthrown, had not heaven again interpoſed by a violent ſtorm of hail, mixed with lightning, which fell on the enemy, and obliged them to retreat. It was found afterwards, that one of the legions, which conſiſted of Chriſtians, had by their prayers, which they offered up on their knees before the battle, obtained this favour from heaven: and from this event that legion was ſirnamed *The thundering Legion*. See, however, the criticiſm of Mr *Moyle* on this ſtory in his *Works*, vol. ii. p. 81—390. See alſo *Moſheim's Church Hiſtory*, vol. i. p. 124.

Such were the primitive Chriſtians, whoſe religion has by degrees ſpread itſelf over all parts of the world, though not with equal purity in all. And though, by the providence of God, Mahometans and Idolaters have been ſuffered to poſſeſs themſelves of thoſe places in Greece, Aſia, and Africa, where the Chriſtian religion formerly moſt flouriſhed; yet there are ſtill ſuch remains of the Chriſtian religion among them as to give them opportunity ſufficient to be converted. For, in the dominions of the Turk in Europe, the Chriſtians make two third parts at leaſt of the inhabitants: and in Conſtantinople itſelf there are above twenty Chriſtian churches, and above thirty in Theſſalonica. Philadelphia, now called *Ala-ſhabir*, has no fewer than twelve Chriſtian churches. The whole iſland of Chio is governed by Chriſtians; and ſome iſlands of the Archipelago are inhabited by Chriſtians only. In Africa, beſides the Chriſtians living in Egypt, and in the kingdom of Congo and Angola, the iſlands upon the weſtern coaſts are inhabited by Chriſtians; and the vaſt kingdom of Abyſſinia, ſuppoſed to be as big as Germany, France, Spain, and Italy, put together, is poſſeſſed by Chriſtians. In Aſia, moſt part of the empire of Ruſſia, the countries of Circaſſia and Mingrelia, Georgia, and Mount Libanus, are inhabited only by Chriſtians. In America, it is notorious that the Chriſtians are very numerous, and ſpread over moſt parts of that vaſt continent.

CHRISTIANS of St John, a ſect of Chriſtians very numerous in Balſara and the neighbouring towns: they formerly inhabited along the river Jordan, where St John baptized, and it was from thence they had their name. They hold an anniverſary feaſt of five days; during which they all go to the biſhop, who baptizes them with the baptiſm of St John. Their baptiſm is alſo performed in rivers, and that only on Sundays: they have no notion of the third Perſon in the Trinity; nor have they any canonical books, but abundance full of charms, &c. Their biſhoprics deſcend by inheritance, as our eſtates do, though they have the ceremony of an election.

Christians of St Thomas, a ſort of Chriſtians in a peninſula of India on this ſide of the Gulf: they inhabit chiefly at Cranganor, and the neighbouring country: theſe admit of no images; and receive only the croſs, to which they pay a great veneration: they affirm, that the ſouls of the ſaints do not ſee God till after the day of judgement: they acknowledge but three ſacraments, *viz.* baptiſm, orders, and the euchariſt: they make no uſe of holy oils in the adminiſtration of baptiſm; but, after the ceremony, anoint the infant with an unction compoſed of oil and walnuts, without any benediction. In the euchariſt, they conſecrate with little cakes made of oil and ſalt, and inſtead of wine make uſe of water in which raiſins have been infuſed.

CHRISTIANA, a town of Norway, in the province of Aggerhuys, ſituated on a bay of the ſea. E. Long. 10. 15. N. Lat. 59. 30.

CHRISTIANOPLE, a port-town of Sweden, ſituated on the Baltic Sea, in the territory of Blecking, and province of South Gothland. E. Long. 15. 40 N. Lat. 57°.

CHRISTIANSTADT, a ſtrong fortified town of Sweden; ſituated in the territory of Blecking and province of South Gothland. It was built in 1614 by Chriſtian IV. king of Denmark, when this province belonged to the Danes; and finally ceded to the Swedes by the peace of Roſkild in 1658. The town is ſmall but neatly built, and is eſteemed the ſtrongeſt fortreſs in Sweden. The houſes are all of brick, and moſtly ſtuccoed white. It ſtands in a marſhy plain cloſe to the river Helge-a, which flows into the Baltic at Ahus about the diſtance of 20 miles, and is navigable only for ſmall craft of ſeven tons burden. Engliſh veſſels annually reſort to this port for alum, pitch, and tar. The inhabitants have manufactures of cloth and ſilken ſtuffs, and carry on a ſmall degree of commerce. E. Long. 14. 40. N Lat. 56. 30.

CHRISTINA, daughter of Guſtavus Adolphus king of Sweden, born in in 1626; and ſucceeded to the crown in 1633, when only ſeven years of age. This princeſs diſcovered even in her infancy, what ſhe afterwards expreſſed in her memoirs, an invincible antipathy for the employments and converſation of women; and ſhe had the natural aukwardneſs of a man with reſpect to all the little works which generally fall to their ſhare. She was on the contrary, fond of violent exerciſes, and ſuch amuſements as conſiſt in feats of ſtrength and activity. She had alſo both ability and taſte for abſtracted ſpeculations; and amuſed herſelf with language and the ſciences, particularly that of legiſlature and government. She derived her knowledge of ancient hiſtory from its ſource: and Polybius and Thucydides were her favourite authors. As ſhe was the ſovereign of a powerful kingdom, it is not ſtrange that almoſt all the princes in Europe aſpired to her bed. Among others, were the Prince of Denmark, the Elector Palatine, the Elector of Brandenburg, the King of Spain, the king of the Romans, Don John of Auſtria; Sigiſmund of Rockocci, count and general of Caſſovia; Stanilaus king of Poland; John Caſimir his brother; and Charles Guſtavus duke of Deux Ponts, of the Bavarian Palatinate family, ſon of her father the great Guſtavus's ſiſter, and conſequently her firſt couſin. To this nobleman, as well as to all his competitors, ſhe conſtantly refuſed her hand; but ſhe cauſed him to be appointed her ſucceſſor by the ſtates. Political intereſts, differences of religion, and contrariety of manners, furniſhed Chriſtina with pretences for rejecting all her ſuitors; but her true motives were the love of independence, and a ſtrong averſion ſhe had conceived, even in her infancy, from the marriage yoke. "Do not force me to marry (ſaid ſhe to the ſtates); for if I ſhould have a ſon, it is not more probable that he ſhould be an Auguſtus than a Nero."

An accident happened in the beginning of her reign which gave her a remarkable opportunity of diſplaying the ſtrength and equanimity of her mind. As ſhe was at the chapel of the caſtle of Stockholm, aſſiſting at divine ſervice with the principal lords of her court, a poor wretch, who was diſordered in his mind, came to the place with a deſign to aſſaſſinate her. This man, who was preceptor of the college, and in the full vigour of his age, choſe, for the execution of his deſign, the moment in which the aſſembly was performing what in the Swediſh church is called an *act of recollection*; a ſilent and ſeparate act of devotion, performed by each individual kneeling and hiding the face with the hand. Taking this opportunity, he ruſhed through the crowd, and mounted a balluſtrade within which the queen was upon her knees. The Baron Braki, chief juſtice of Sweden, was alarmed, and cried out; and the guards croſſed their partiſans, to prevent his coming further: but he ſtruck them furiouſly on one ſide; leaped over the barrier; and, being then cloſe to the queen, made a blow at her with a knife which he had concealed without a ſheath in his ſleeve. The queen avoided the blow, and puſhed the captain of her guards, who inſtantly threw himſelf upon the aſſaſſin, and ſeized him by the hair. All this happened in leſs than a moment of time. The man was known to be mad, and therefore nobody ſuppoſed he had any accomplices: they therefore contented themſelves with locking him up; and the queen returned to her devotion without the leaſt emotion that could be perceived by the people, who were much more frightened than herſelf.

One of the great affairs that employed Chriſtina while ſhe was upon the throne, was the peace of Weſtphalia, in which many claſhing intereſts were to be reconciled, and many claims to be aſcertained. It was concluded in the month of October 1648. The ſucceſs of the Swediſh arms rendered Chriſtina the arbitreſs of this treaty; at leaſt as to the affairs of Sweden, to which this peace confirmed the poſſeſſion of many important countries. No public event of importance took place during the reſt of Chriſtina's reign; for there were neither wars abroad, nor troubles at home. This quiet might be the effect of chance; but it might alſo be the effect of a good ad-

Chriſtina. miniſtration, and the great reputation of the queen; and the love her people had for her ought to lead us to this determination. Her reign was that of learning and genius. She drew about her, wherever ſhe was, all the diſtinguiſhed characters of her time: Grotius, Paſcal, Bochart, Deſcartes, Gaſſendi, Saumaiſe, Naude, Voſſius, Heinſius, Meibom, Scudery, Menage, Lucas, Holſtenius, Lambecius, Bayle, madam Dacier, Filicaia, and many others. The arts never fail to immortalize the prince who protects them; and almoſt all theſe illuſtrious perſons have celebrated Chriſtina, either in poems, letters, or literary productions of ſome other kind, the greater part of which are now forgotten. They form, however, a general cry of praiſe, and a maſs of teſtimonials which may be conſidered as a ſolid baſis of reputation. Chriſtina, however, may be juſtly reproached with want of taſte, in not properly aſſigning the rank of all theſe perſons, whoſe merits, though acknowledged, were yet unequal; particularly for not having been ſufficiently ſenſible of the ſuperiority of Deſcartes, whom ſhe diſguſted, and at laſt wholly neglected. The rapid fortune which the adventurer Michon, known by the name of *Bourdelot*, acquired by her countenance and liberality, was alſo a great ſcandal to literature. He had no pretenſions to learning; and though ſprightly, was yet indecent. He was brought to court by the learned Saumaiſe; and, for a time drove literary merit entirely out of it, making learning the object of his ridicule, and exacting from Chriſtina an exorbitant tribute to the weakneſs and inconſtancy of her ſex; for even Chriſtina, with reſpect to this man, ſhowed herſelf to be weak and inconſtant. At laſt ſhe was compelled, by the public indignation, to baniſh this unworthy minion; and he was no ſooner gone, than her regard for him was at an end. She was aſhamed of the favour ſhe had ſhown him; and in a ſhort time, thought of him with hatred or contempt. This Bourdelot, during his aſcendency over the queen, had ſupplanted count Magnus de la Gardie, ſon of the conſtable of Sweden, who was a relation, a favourite, and perhaps the lover of Chriſtina. M. de Motteville, who had ſeen him ambaſſador in France, ſays, in his memoirs, that he ſpoke of his queen in terms ſo paſſionate and reſpectful, that every one concluded his attachment to her to be more ardent and tender, than a mere ſenſe of duty can produce. This nobleman fell into diſgrace becauſe he ſhowed an inclination to govern; while M. Bourdelot ſeemed to aim at nothing more than to amuſe; and concealed, under the unſuſpected character of a droll, the real aſcendency which he exerciſed over the queen's mind.

About this time, an accident happened to Chriſtina which brought her into ſtill greater danger, than that which has been related already. Having given orders for ſome ſhips of war to be built at the port of Stockholm, ſhe went to ſee them when they were finiſhed; and as ſhe was going on board of them, croſs a narrow plank, with admiral Fleming, his foot ſlipping, he fell, and drew the queen with him into the ſea, which in that place was near 90 feet deep. Anthony Steinberg, the queen's firſt equerry, inſtantly threw himſelf into the water, laid hold of her robe, and, with ſuch aſſiſtance as was given him, got the queen aſhore: during this accident, her recollection was ſuch, that the moment her lips were above water, ſhe cried, out, "Take care of the Admiral." When ſhe was got out of the water, ſhe diſcovered no emotion either by her geſture or countenance; and ſhe dined the ſame day in public, where ſhe gave a humorous account of her adventure.

Chriſtina. But, though at firſt ſhe was fond of the power and ſplendor of royalty, yet ſhe began at length to feel that it embarraſſed her; and the ſame love of independence and liberty which had determined her againſt marriage, at laſt made her weary of her crown. As, after her firſt diſguſt, it grew more and more irkſome to her, ſhe reſolved to abdicate; and, in 1652, communicated her reſolution to the ſenate. The ſenate zealouſly remonſtrated againſt it; and was joined by the people; and even by Charles Guſtavus himſelf, who was to ſucceed her: ſhe yielded to their importunities, and continued to ſacrifice her own pleaſure to the will of the public till the year 1654, and then ſhe carried her deſign into execution. It appears by one of her letters to to M. Canut, in whom ſhe put great confidence, that ſhe had meditated this project for more than eight years; and that ſhe had communicated it to him five years before it took place.

The ceremony of her abdication was a mournful ſolemnity, a mixture of pomp and ſadneſs, in which ſcarce any eyes but her own were dry. She continued firm and compoſed through the whole; and, as ſoon as it was over, prepared to remove into a country more favourable to ſcience than Sweden was. Concerning the merit of this action, the world has always been divided in opinion; it has been condemned alike both by the ignorant and the learned, the trifler and the ſage. It was admired, however, by the great Condé: "How great was the magnanimity of this princeſs (ſaid he), who could ſo eaſily give up that for which the reſt of mankind are continually deſtroying each other, and which ſo many throughout their whole lives, purſue without attaining!" It appears by the works of St Evermond, that the abdication of Chriſtina was at that time the univerſal topic of ſpeculation and debate in France. Chriſtina, beſides abdicating her crown, abjured her religion: but this act was univerſally approved by one party and cenſured by another; the Papiſts triumphed, and the Proteſtants were offended. No prince, after a long impriſonment, ever ſhowed ſo much joy upon being reſtored to his kingdom, as Chriſtina did in quitting hers. When ſhe came to a little brook, which ſeparates Sweden from Denmark, ſhe got out of her carriage; and leaping to the other ſide, cried out in a tranſport of joy, "At laſt I am free, and out of Sweden, whither I hope I ſhall never return." She diſmiſſed her women, and laid by the habit of her ſex: "I would become a man (ſaid ſhe); yet I do not love men becauſe they are men, but becauſe they are not women." She made her abjuration at Bruſſels; where ſhe ſaw the great Condé, who, after his defection, made that city his aſylum. "Couſin (ſaid ſhe), who would have thought ten years ago, that we ſhould have met at this diſtance from our countries?"

The inconſtancy of Chriſtina's temper appeared in her going continually from place to place: from Bruſſels ſhe went to Rome; from Rome to France, and from France ſhe returned to Rome again; after this ſhe went to Sweden, where ſhe was not very well received; from Sweden ſhe went to Hamburgh, where ſhe continued a year, and then went again to Rome; from Rome ſhe returned to Hamburgh; and again to Sweden, where ſhe was ſtill worſe received than before; upon which ſhe went back to Hamburgh, and from Hamburgh again to Rome. She intended another journey to Sweden; but it did not take place, any more than an expedition to England, where Cromwell did not ſeem well diſpoſed to receive her; and after many wanderings, and many purpoſes of wandering ſtill more, ſhe at laſt died at Rome in 1689.

It muſt be acknowledged, that her journeys to Sweden had a motive of neceſſity; for her appointments were very ill paid, though the ſtates often confirmed them after her abdication: but to other places ſhe was led merely by a roving diſpoſition; and, what is more to her diſcredit, ſhe always diſturbed the quiet of every place ſhe came into, by exacting greater deference to her rank as queen than ſhe had a right to expect, by her total non-conformity to the cuſtoms of the place, and by continually exciting and fomenting intrigues of ſtate. She was indeed always too buſy, even when ſhe was upon the throne; for there was no event in Europe in which ſhe was not ambitious of acting a principal part. During the troubles in France by the faction called the *Fronde*, ſhe wrote with great eagerneſs to all the intereſted parties, officiouſly offering her mediation to reconcile their intereſts, and calm their paſſions, the ſecret ſprings of which it was impoſſible ſhe ſhould know. This was firſt thought a dangerous, and afterwards a ridiculous, behaviour. During her reſidence in France ſhe gave univerſal diſguſt, not only by violating all the cuſtoms of the country, but by practiſing others directly oppoſite. She treated the ladies of the court with the greateſt rudeneſs and contempt: when they came to embrace her, ſhe, being in man's habit, cried out, "What a ſtrange eagerneſs have theſe women to kiſs me! is it becauſe I look like a man?"

But though ſhe ridiculed the manners of the French court, ſhe was very ſolicitous to enter into its intrigues. Louis XIV. then very young, was enamoured of Mademoiſelle de Mancini niece to Cardinal Mazarine; Chriſtina flattered their paſſion, and offered her ſervice. "I would fain be your confident (ſaid ſhe); if you love, you muſt marry."

The murder of Monaldeſchi is, to this hour, an inſcrutable myſtery. It is, however, of a piece with the expreſſions conſtantly uſed by Chriſtina in her letters, with reſpect to thoſe with whom ſhe was offended; for ſhe ſcarce ever ſignified her diſpleaſure without threatening the life of the offender. "If you fail in your duty, (ſaid ſhe to her ſecretary, whom ſhe ſent to Stockholm after her abdication), not all the power of the king of Sweden ſhall ſave your life, though you ſhould take ſhelter in his arms." A muſician having quitted her ſervice for that of the duke of Savoy, ſhe was ſo tranſported with rage as to diſgrace herſelf by theſe words, in a letter written with her own hand: "He lives only for me; and if he does not ſing for me, he ſhall not long ſing for any body."

Bayle was alſo threatened for having ſaid that the letter which Chriſtina wrote, upon the revocation of the edict of Nantes, was "a remain of Proteſtantiſm;" but he made his peace by apologies and ſubmiſſion. See the article BAYLE.

Upon the whole, ſhe appears to have been an uncommon mixture of faults and great qualities; which, however it might excite fear and reſpect, was by no means amiable. She had wit, taſte, parts, and learning: ſhe was indefatigable upon the throne; great in private life; firm in misfortunes; impatient of contradiction; and, except in her love of letters, inconſtant in her inclinations. The moſt remarkable inſtance of this fickleneſs is, That after ſhe had abdicated the crown of Sweden, ſhe intrigued for that of Poland. She was, in every action and purſuit, violent and ardent in the higheſt degree; impetuous in her deſires, dreadful in her reſentment, and fickle in her conduct.

She ſays of herſelf, "that ſhe was miſtruſtful, ambitious, paſſionate, haughty, impatient, contemptuous, ſatyrical, incredulous, undevout, of an ardent and violent temper, and extremely amorous;" a diſpoſition, however, to which, if ſhe may be believed, her pride and her virtue were always ſuperior. In general, her failings were thoſe of her ſex, and her virtues the virtues of ours.

Santa-CHRISTINA, one of the MARQUESAS *Iſlands*.

CHRISTMAS-DAY, a feſtival of the Chriſtian church; obſerved on the 25th of December, in memory of the *nativity* or birth of Jeſus Chriſt. As to the antiquity of this feſtival, the firſt footſteps we find of it are in the ſecond century, about the time of the emperor Commodus. The decretal epiſtles indeed carry it up a little higher; and ſay that Teleſphorus, who lived in the reign of Antoninus Pius, ordered divine ſervice to be celebrated, and an angelical hymn to be ſung, the night before the nativity of our Saviour. However, that it was kept before the times of Conſtantine we have a melancholy proof: for whilſt the perſecution raged under Diocleſian, who then kept his court at Nicomedia, that prince, among other acts of cruelty, finding multitudes of Chriſtians aſſembled together to celebrate Chriſt's nativity, commanded the church-doors where they were met to be ſhut, and fire to be put to it, which, in a ſhort time, reduced them and it to aſhes.

CHRISTOPHER'S, St. one of the Caribbee Iſlands, in America, lying to the north-weſt of Nevis, and about 60 miles weſt of Antigua. It was formerly inhabited by the French and Engliſh; but, in 1713, it was ceded entirely to the latter. In 1782, it was taken by the French, but reſtored to Britain at the peace. It is about 20 miles in breadth and ſeven in length; and has high mountains in the middle, whence rivulets run down. Between the mountains are dreadful rocks, horrid precipices, and thick woods; and in the ſouth-weſt part of the iſland, hot ſulphureous ſprings at the foot of them. The air is good; the ſoil, light, ſandy, and fruitful; but the iſland is ſubject to hurricanes. The produce is chiefly ſugar, cotton, ginger, indigo, and the tropical fruits. W. Long. 62. 32. N. Lat. 17. 30.

CHROASTACES, in natural hiſtory, a genus of pellucid gems, comprehending all thoſe of variable colours, as viewed in different lights; of which kinds are the *opal* and the *aſteria* or *oculus cati*. See Opal and Asteria.

CHROMATIC, a kind of muſic which proceeds by ſeveral ſemitones in ſucceſſion. The word is derived from the Greek χρωμα, which ſignifies *colour*. For this denomination ſeveral cauſes are aſſigned, of which none appear certain, and all equally unſatisfactory. Inſtead, therefore, of fixing upon any, we ſhall offer a conjecture of our own; which, however, we do not impoſe upon the reader as more worthy of his attention than any of the former. Χρωμα may perhaps not only ſignify a *colour*, but that ſhade of a colour by which it melts into another, or what the French call *nuance*. If this interpretation be admitted, it will be highly applicable to ſemitones; which being the ſmalleſt interval allowed in the diatonic ſcale, will moſt eaſily run one into another. To find the reaſons aſſigned by the ancients for this denomination, and their various diviſions of the chromatic ſpecies, the reader may have recourſe to the ſame article in Roſſeau's Muſical Dictionary. At preſent, that ſpecies conſiſts in giving ſuch a procedure to the fundamental baſs, that the parts in the harmony, or at leaſt ſome of them may proceed by ſemitones, as well in riſing as deſcending; which is moſt frequently found in the minor mode, from the alterations to which the ſixth and ſeventh note are ſubjected, by the nature of the mode itſelf.

The ſucceſſive ſemitones uſed in the *chromatic* ſpecies are rarely of the ſame kind; but alternately major and minor, that is to ſay, *chromatic* and *diatonic*: for the interval of a minor tone contains a major or chromatic ſemitone, and another which is major or diatonic; a meaſure which temperament renders common to all tones: ſo that we cannot proceed by two minor ſemitones which are conjunctive in ſucceſſion, without entering into the enharmonic ſpecies; but two major ſemitones twice follow each other in the *chromatic* order of the ſcale.

The moſt certain procedure of the fundamental baſs to generate the chromatic elements in aſcent, is alternately to deſcend by thirds, and riſe by fourths, whilſt all the chords carry the third major. If the fundamental baſs proceeds from dominant to dominant by perfect cadences avoided, it produces the *chromatic* in deſcending. To produce both at once, you interweave the perfect and broken cadences, but at the ſame time avoid them.

As at every note in the *chromatic* ſpecies one muſt change the tone, that ſucceſſion ought to be regulated and limited for fear of deviation. For this purpoſe, it will be proper to recollect, that the ſpace moſt ſuitable to *chromatic* movements, is between the extremes of the dominant and the tonic in aſcending, and between the tonic and the dominant in deſcending. In the major mode, one may alſo chromatically deſcend from the dominant upon the ſecond note. This tranſition is very common in Italy; and, notwithſtanding its beauty, begins to be a little too common amongſt us.

The chromatic ſpecies is admirably fitted to expreſs grief and affliction: theſe ſounds boldly ſtruck in aſcending tear the ſoul. Their power is no leſs magical in deſcending; it is then that the ear ſeems to be pierced with real groans. Attended with its proper harmony, this ſpecies appears proper to expreſs every thing: but its completion, by concealing the melody, ſacrifices a part of its expreſſion: and for this diſadvantage, ariſing from the fullneſs of the harmony, it can only be compenſated by the nature and genius of the movement. We may add, that in proportion to the energy of this ſpecies, the compoſer ought to uſe it with greater caution and parſimony. Like thoſe delicate viands, which when profuſely adminiſtered, immediately ſurfeit us with their abundance: as much as they delight us when enjoyed with temperance, ſo much do they diſguſt when devoured with prodigality.

Chromatic, *Enharmonic*. See Enharmonic.

CHROMATICS;

That part of optics which explains the ſeveral properties of the colours of light, and of natural bodies.

1 Different hypotheſes concerning colours.

Before the time of Sir Iſaac Newton, we find no hypotheſis concerning colours of any conſequence. The opinions of the old philoſophers, however, we ſhall briefly mention, in order to gratify the curioſity of our readers. The Pythagoreans called colour the ſuperficies of body. Plato ſaid that it was a flame iſſuing from them. According to Zeno, it is the firſt configuration of matter; and Ariſtotle ſaid it was that which moved bodies actually tranſparent. Deſcartes aſſerted, that colour is a modification of light; but he imagined, that the difference of colour proceeds from the prevalence of the direct or rotatory motion of the particles of light. Father Grimaldi, Dechales, and many others, thought the differences of colour depended upon the quick or ſlow vibrations of a certain elaſtic medium filling the whole univerſe. Rohault imagined, that the different colours were made by the rays of light entering the eye at different angles with reſpect to the optic axis; and from the phænomenon of the rainbow, he pretended to calculate the preciſe quantity of the angle that conſtituted each particular colour. Laſtly, Dr Hooke, the rival of Newton, imagined that colour is cauſed by the ſenſation of the oblique or uneven pulſe of light: and this being capable of no more than two varieties, he concluded there could be no more than two primary colours.

2 This ſubject inveſtigated by Sir Iſaac Newton.

In the year 1666, Sir Iſaac Newton began to inveſtigate this ſubject; and finding the coloured image of the ſun, formed by a glaſs priſm, to be of an oblong, and not of a circular form, as, according to the laws of refraction, it ought to be, he began to conjecture that light is not *homogeneal*; but that it conſiſts of rays, ſome of which are much more refrangible than others. See this diſcovery fully explained and aſcertained under the article Optics.

This method of accounting for the different colours of bodies, from their reflecting this or that kind of rays moſt copiouſly, is ſo eaſy and natural, that Sir Iſaac's ſyſtem quickly overcame all objections, and to this day continues to be almoſt univerſally believed. It is now acknowledged, that the light of the ſun, which to us ſeems perfectly homogeneal and white, is compoſed of no fewer than ſeven different colours, *viz.* red, orange, yellow, green, blue, purple, and violet or indigo. A body which appears of a red colour, hath the property of reflecting the red rays more powerfully than any of the others; and ſo of the orange, yellow, green, &c. A body which is of a black colour, inſtead of reflecting, *abſorbs* all or the greateſt part of the rays that fall upon it; and, on the contrary, a body which appears white, reflects the greateſt part of the rays indiſcriminately, without ſeparating the one from the other.

3
Colours appearing between two glaſs plates.

The foundation of a rational theory of colours being thus laid, it next became natural to inquire, by what peculiar mechaniſm in the ſtructure of each particular body it was fitted to reflect one kind of rays more than another? This Sir Iſaac Newton attributes to the denſity of theſe bodies. Dr Hooke had remarked, that thin tranſparent ſubſtances, particularly water and ſoap blown into bubbles, exhibited various colours according to their thinneſs, though, when they have a conſiderable degree of thickneſs, they appear colourleſs; and Sir Iſaac himſelf had obſerved, that as he was compreſſing two priſms hard together, in order to make their ſides (which happened to be a little convex) to touch one another, in the place of contact they were both perfectly tranſparent, as if they had been but one continued piece of glaſs. Round the point of contact, where the glaſſes were a little ſeparate from each other, rings of different colours appeared. To obſerve more nicely the order of the colours produced in this manner, he took two object-glaſſes; one of them a plano-convex one belonging to a 14 feet refracting teleſcope, and the other a large double convex one for a teleſcope of about 50 feet; and laying the former of them upon the latter, with its plain ſide downwards, he preſſed them ſlowly together; by which means the colours very ſoon emerged, and appeared diſtinct to a conſiderable diſtance. Next to the pellucid central ſpot, made by the contact of the glaſſes, ſucceeded blue, white, yellow, and red. The blue was very little in quantity, nor could he diſcern any violet in it; but the yellow and red were very copious, extending about as far as the white, and four or five times as far as the blue. The next circuit immediately ſurrounding theſe, conſiſted of violet, blue, green, yellow, and red: all theſe were copious and vivid, except the green, which was very little in quantity, and ſeemed more faint and dilute than the other colours. Of the other four, the violet was the leaſt in extent; and the blue leſs than the yellow or red. The third circle of colours was purple, blue, green, yellow, and red. In this the purple ſeemed more reddiſh than the violet in the former circuit and the green was more conſpicuous; being as briſk and copious as any of the other colours, except the yellow; but the red began to be a little faded, inclining much to purple. The fourth circle conſiſted of green and red; and of theſe the green was very copious and lively, inclining on the one ſide to blue, and on the other to yellow; but in this fourth circle there was neither violet, blue, nor yellow, and the red was very imperfect and dirty. All the ſucceeding colours grew more and more imperfect and dilute, till after three or four revolutions they ended in perfect whiteneſs.

4
Suppoſed ariſe from denſity.

As the colours were thus found to vary according to the different diſtances of the glaſs-plates from each other, our author thought that they proceeded from the different thickneſs of the plate of air intercepted between the glaſſes; this plate of air being, by the mere circumſtance of thinneſs or thickneſs, diſpoſed to reflect or tranſmit this or that particular colour. From this he concluded, as already obſerved, that the colours of all natural bodies depended on their denſity, or the bigneſs of their component particles. He alſo conſtructed a table, wherein the thickneſs of a plate neceſſary to reflect any particular colour was expreſſed in parts of an inch divided into 1,000,000 parts.

5
Colours by reflection.

Sir Iſaac Newton purſuing his diſcoveries concerning the colours of thin ſubſtances, found that the ſame were alſo produced by plates of a conſiderable thickneſs. There is no glaſs or ſpeculum, he obſerves, how well poliſhed ſoever, but, beſides the light which it refracts or reflects regularly, ſcatters every way irregularly a faint light; by means of which the poliſhed ſurface, when illuminated in a dark room by a beam of the ſun's light, may eaſily be ſeen in all poſitions of the eye. It was with this ſcattered light that the colours in the following experiments were produced.

The ſun ſhining into his darkened chamber through a hole in the ſhutter one inch wide, he let the beam of light fall perpendicularly upon a glaſs ſpeculum, concave on one ſide and convex on the other, ground to a ſphere of five feet eleven inches radius, and quickſilvered over on the convex ſide. Then, holding a quire of white paper at the centre of the ſphere, to which the ſpeculums were ground, in ſuch a manner as that the beam of light might paſs through a little hole made in the middle of the paper, to the ſpeculum, and thence be reflected back to the ſame hole, he obſerved on the paper four or five concentric rings of colours, like rainbows ſurrounding the hole, very much like thoſe which appeared in the thin plates abovementioned, but larger and fainter. Theſe rings, as they grew larger and larger, became more dilute, ſo that the fifth was hardly viſible; and yet ſometimes, when the ſun ſhone very clear, there appeared faint traces of a ſixth and ſeventh.

6
Colours by refraction and reflection enumerated.

We have already taken notice, that the thin plates made uſe of in the former experiments reflected ſome kinds of rays in particular parts, and tranſmitted others in the ſame parts. Hence the coloured rings appeared variouſly diſpoſed, according as they were viewed by tranſmitted or reflected light; that is, according as the plates were held up between the light and the eye, or not. For the better underſtanding of which we ſubjoin the following table, wherein on one ſide are mentioned the colours appearing on the plates by reflected light, and on the other thoſe which were oppoſite to them, and which became viſible when the glaſſes were held up between the eye and the window. We have already obſerved, that the centre, when the glaſſes were in full contact, was perfectly tranſparent. This ſpot, therefore, when viewed by reflected light, appeared black, becauſe it tranſmitted all the rays: and for the ſame reaſon it appeared white when viewed by tranſmitted light.

Colours by reflected Light.	*Colours by Tranſmitted Light.*
Black	White
Blue	Yellowiſh-red
White	Black
Yellow	Violet
Red	Blue
Violet	White
Blue	Yellow
Green	Red
Yellow	Violet
Red	Blue
Purple	Green
Blue	Yellow
Green	Red
Yellow Red	Bluiſh-green
Green	Red
Red	Bluiſh-green
Greeniſh-blue	Red.
Red.	

The colours of the rings produced from reflection by the thick plates, followed the order of thoſe produced by tranſmiſſion through the thin ones: and by the analogy of their phenomena with thoſe produced from the thin plates, Sir Iſaac Newton concluded that they were produced in a ſimilar manner. For he found, that if the quickſilver was rubbed off from the back of the ſpeculum, the glaſs alone would produce the ſame rings, but much more faint than before; ſo that the phenomenon did not depend upon the quickſilver, except in as far as, by increaſing the reflection at the back of the glaſs, it increaſed the light of the coloured rings. He alſo found that a ſpeculum of metal only, produced none of thoſe rings; which made him conclude, that they did not ariſe from one ſurface only, but depended on the two ſurfaces of the plate of glaſs of which the ſpeculum was made, and upon the thickneſs of the glaſs between them.

7
General theory of colours by Sir Iſaac Newton.

From theſe experiments and obſervations, it will be eaſy to underſtand the Newtonian theory of colours. Every ſubſtance in nature ſeems to be tranſparent, provided it is made ſufficiently thin. Gold, the moſt denſe ſubſtance we know, when reduced into thin leaves, tranſmits a bluiſh-green light through it. If, therefore, we ſuppoſe any body, gold, for inſtance, to be divided into a vaſt number of plates ſo thin as to be almoſt perfectly tranſparent, it is evident that all or greateſt part of the rays will paſs through the upper plates, and when they loſe their force will be reflected from the under ones. They will then have the ſame number of plates to paſs through which they had penetrated before; and thus, according to the number of thoſe plates through which they are obliged to paſs, the object appears of this or that colour, juſt as the rings of colours appeared different in the experiment of the two plates, according to their diſtance from one another, or the thickneſs of the plate of air between them.

8
Mr Delaval's experiments in confirmation of it.

This theory is adopted by Edward Huſſey Delaval, in his Experimental Inquiry into the cauſe of the changes of colours in opaque and coloured bodies. He endeavours to confirm it by a number of experiments on the infuſions of flowers of different colours; but his ſtrongeſt arguments ſeem to be thoſe derived from the different tinges given to glaſs by metallic ſubſtances. Here he obſerves, that each metal gives a tinge according to its ſpecific denſity; the more denſe metals producing the leſs refrangible colours, and the lighter ones thoſe colours which are more eaſily refrangible. Gold, which is the denſeſt of all metals, imparts a red colour to glaſs, whenever it can be divided into particles ſo minute, that it is capable of being mixed with the materials of which glaſs is made. It ſeems indifferent by what means it is reduced to this ſtate, nor can it by any means be made to produce another colour. If it is mixed in large maſſes without being minutely divided, it imparts no colour to the glaſs, but remains in its metallic form. Lead, the metal whoſe denſity is next in order to that of gold, affords a glaſs of the colour of the hyacinth; a gem whoſe diſtinguiſhing characteriſtic is, that it is red with an admixture of yellow, the ſame colour which is uſually called *orange*. Glaſs of lead is mentioned by ſeveral authors as a compoſition proper, without the addition of any other ingredient, for imitating the hyacinth. Silver, next in denſity to lead, can only be made to communicate a yellow colour to glaſs. If the metal is calcined with ſulphur, it readily communicates this colour. Leaf-ſilver laid upon red-hot glaſs likewiſe tinges it yellow. When we meet with authors who mention a blue or greeniſh colour communicated by ſilver, the cauſe, muſt have been, that the ſilver uſed in ſuch proceſſes was mixed with copper. Mr Delaval aſſures us, from his own experience, that ſilver purified by the teſt retains ſo much copper, that, when melted ſeveral times with nitre and borax, it always imparted a green colour at the firſt and ſecond melting; though afterwards no ſuch colour was obtainable from it. The only colour produced by copper is green. It is indifferent in what manner the copper is prepared in order to tinge the glaſs, provided it is expoſed without any other ingredient to a ſufficient degree of heat. If a quantity of ſalts are added in the preparation, they will, by attenuating the mixture, make the glaſs incline to blue, the colour next in order: but this happens only when the fire is moderate; for, in a greater degree of heat, the redundant ſalts, even thoſe of the moſt fixed nature, are expelled. It is true, that copper is mentioned by ſome writers as an ingredient in red glaſs and enamel: but the *red*, which is the colour of the metal not diſſolved or mixed with the glaſs, remains only while the compoſition is expoſed to ſuch a degree of heat as is too ſmall to melt and incorporate it; for, if it be ſuffered to remain in the furnace a few minutes after the copper is added, the maſs will turn out green inſtead of red. Iron, the metal next in denſity to copper, is apt to be calcined, or reduced to a ruddy crocus, ſimilar to that ruſt which it contracts ſpontaneouſly in the air. In this ſtate, it requires a conſiderable degree of heat to diſſolve and incorporate it with glaſs: till that heat is applied, it retains its ruddy colour: by increaſing the heat, it paſſes through the intermediate colours, till it arrives at its permanent one, which is blue; this being effected in the greateſt degree of heat.

the glaſs will bear, without loſing all colour whatever. Iron vitrified *per ſe* is converted into a blue glaſs. In ſhort, it is indubitable, that iron is the only metal which will, without any addition, impart to the glaſs a blue colour: for copper will not communicate that colour without the addition of a conſiderable quantity of ſalts; or ſome other matter that attenuates it; and the other metals cannot by any means be made to produce it at all.

9 Sir Iſaac's theory defended by Dr Prieſtley.

Theſe are the principal of Mr Delaval's arguments in favour of Sir Iſaac Newton's theory of colours being formed by denſity. Dr Prieſtley too hath mentioned ſome which deſerve attention. "It was a diſcovery of Sir Iſaac Newton (ſays he), that the colours of bodies depend upon the thickneſs of the fine plates which compoſe their ſurfaces. He hath ſhown, that a change of the thickneſs of theſe plates occaſions a change in the colours of the body; rays of a different colour being thereby diſpoſed to be tranſmitted through it; and conſequently rays of a different colour reflected at the ſame place, ſo as to preſent an image of a different colour to the eye. A variation in the denſity occaſions a variation in the colour; but ſtill a medium of any denſity will exhibit all the colours, according to the thickneſs of it. Theſe obſervations he confirmed by experiments on plates of air, water, and glaſs. He likewiſe mentions the colours which ariſe on poliſhed ſteel by heating it, as likewiſe on bell-metal, and ſome other metalline ſubſtances, when melted and poured on the ground, where they may cool in the open air; and he aſcribes them to the ſcoriae or vitrified parts of the metal, which, he ſays, moſt metals, when heated or melted, do continually protrude and ſend out to their ſurfaces, covering them in the form of a thin glaſſy ſkin. This great diſcovery concerning the colours of bodies depending on the thickneſs of the fine plates which compoſe their ſurfaces, of whatever denſity theſe plates may be, I have been ſo happy as to hit upon a method of illuſtrating and confirming by means of electrical exploſions.

10 His experiments.

A number of theſe being received on the ſurface of any piece of metal, change the colour of it to a conſiderable diſtance from the ſpot on which they were diſcharged; ſo that the whole circular ſpace is divided into a number of concentric rings, each of which conſiſts of all the priſmatic colours, and perhaps as vivid as they can be produced in any method whatever.

11 Mr Canton's experiments.

Upon ſhowing theſe coloured rings to Mr Canton, I was agreeably ſurpriſed to find, that he had likewiſe produced all the priſmatic colours from all the metals, but by a different operation. He extended fine wires of all the different metals along the ſurfaces of pieces of glaſs, ivory, wood, &c.; and when the wire was exploded, he always found them tinged with all the colours. They are not diſpoſed in ſo regular and beautiful a manner as in the rings I produced, but they equally demonſtrate that none of the metals thus exploded diſcovers the leaſt preference to one colour more than to another. In what manner theſe colours are formed it may not be eaſy to conjecture. In Mr Canton's method of producing them, the metal, or the calcined and vitrified parts of it, ſeem to be diſperſed, in all directions from the place of exploſion, in the form of ſpheres of a very great variety of ſizes, tinged with all the variety of colours, and ſome of them ſmaller than can be diſtinctly ſeen by any magnifier. In my method of making theſe colours, they ſeem to be produced in a manner ſimilar to the production of colours on ſteel and other metals by heat; *i. e.* the ſurface is affected without the parts of it being removed from their places, certain plates or laminae being formed of a thickneſs proper to exhibit the reſpective colours."

12 Newtonian theory impugned by Dr Prieſtley.

But, however well ſupported this doctrine of the formation of colours by denſity may be, we find the ſame author (Dr Prieſtley), whom we have juſt now ſeen arguing for it in his hiſtory of electricity, arguing againſt it in his hiſtory of viſion. "There are (ſays he) no optical experiments with which Sir Iſaac Newton ſeems to have taken more pains than thoſe relating to the rings of colours which appear in thin plates; and in all his obſervations and inveſtigations concerning them, he diſcovers the greateſt ſagacity both as a philoſopher and mathematician; and yet in no ſubject to which he gave his attention, does he ſeem to have overlooked more important circumſtances in the appearances he obſerved, or to have been more miſtaken with regard to their cauſes. The former will be evident from the obſervations of thoſe who ſucceeded him in theſe inquiries, particularly thoſe of the Abbe Mazeas.

13 Curious experiments by the Abbe Mazeas.

This gentleman, endeavouring to give a very high poliſh to the flat ſide of an object-glaſs, happened to be rubbing it againſt another piece of flat and ſmooth glaſs; when he was ſurpriſed to find, that after this friction, they adhered very firmly together, till at laſt he could not move the one upon the other. But he was much more ſurpriſed to obſerve the ſame colours between theſe plane glaſſes that Newton obſerved between the convex object-glaſs of a teleſcope and another that was plane. Theſe colours between the plane glaſſes, the Abbe obſerves, were in proportion to their adheſion. The reſemblance between them and the colours produced by Newton, induced him to give a very particular attention to them; and his obſervations and experiments are as follow:

"If the ſurfaces of the pieces of glaſs are tranſparent, and well poliſhed, ſuch as are uſed for mirrors, and the preſſure be as equal as poſſible on every part of the two ſurfaces, a reſiſtance, he ſays, will ſoon be perceived when one of them is made to ſlide over the other; ſometimes towards the middle, and ſometimes towards the edges; but wherever the reſiſtance is felt, two or three very fine curve lines will be perceived, ſome of a pale red, and others of a faint green. Continuing the friction, theſe red and green lines increaſe in number at the place of contact, the colours being ſometimes mixed without any order, and ſometimes diſpoſed in a regular manner. In the laſt caſe, the coloured lines are generally concentric circles, or ellipſes, or rather ovals, more or leſs elongated as the ſurfaces are more or leſs united. Theſe figures will not fail to appear, if the glaſſes are well wiped and warmed before the friction.

"When the colours are formed, the glaſſes adhere with conſiderable force, and would always continue ſo without any change in the colours. In the centre of all thoſe ovals, the longer diameter of which generally exceeds ten lines, there appears a ſmall plate of the ſame figure, exactly like a plate of gold interpoſed between the glaſſes; and in the centre of it there is often a dark ſpot, which abſorbs all the rays of light except the violet; for this colour appears very vivid through a priſm.

“ If the glaſſes are ſeparated ſuddenly, either by ſliding them horizontally over one another, or by the action of fire, as will be explained hereafter, the colours will appear immediately upon their being put together again, without the leaſt friction.

“ Beginning by the ſlighteſt touch, and increaſing the preſſure by inſenſible degrees, there firſt appears an oval plate of a faint red, and in the midſt of it a ſpot of light green, which enlarges by the preſſure, and becomes a green oval, with a red ſpot in the centre; and this, enlarging in its turn, diſcovers a green ſpot in its centre. Thus the red and the green ſucceed one another in turns, aſſuming different ſhades, and having other colours mixed with them, which will be diſtinguiſhed preſently.

“ The greateſt difference between theſe colours exhibited between plane ſurfaces and thoſe formed by curve ones is, that in the former caſe preſſure alone will not produce them, except in the caſe abovementioned. With whatever force he compreſſed them, his attempts to produce the colours were in vain without previous friction. But the reaſon of this plainly was, that without ſliding one of the glaſſes over the other, they could not be brought to approach near enough for the purpoſe.

“ Having made theſe obſervations with plates of glaſs whoſe ſides were nearly parallel, he got two priſms with very ſmall refracting angles; and rubbing them together, when they were ſo joined as to form a parallelopiped, the colours appeared with a ſurpriſing luſtre at the places of contact, owing, he did not doubt, to the ſeparation of the rays of light by the priſm. In this caſe, differently coloured ovals appeared, but the plate of gold in them was much whiter, and only appeared yellow about its edges. This plate having a black ſpot in its centre, was bordered by a deep purple. He could not perceive any violet by his naked eye, but it might be perceived by the help of a lens with a weak light. It appeared in a very ſmall quantity at the confines of the purple and the blue, and ſeemed to him to be only a mixture of theſe two colours. It was very viſible in each of the coloured rings by inclining the glaſſes to the light of the moon. Next to the purple and violet appeared blue, orange, red tinged with purple, light green, and faint purple. The other rings appeared to the naked eye to conſiſt of nothing but faint reds and greens; and they were ſo ſhaded that it was not eaſy to mark their terminations. That the order of theſe may be compared with Newton's, he gives a view of both in the following table:

	Order of the Colours in the Plane Glaſſes.	*Order of the Colours in Newt. Object Glaſſes.*
Order I.	Black ſpot	Black
	Whitiſh oval	Blue
	Yellow border	White
	Deep purple	Yellow
		Red
Order II.	Blue	Violet.
	Orange	Blue
	Purple	Green
		Yellow
		Red.
Order III.	Greeniſh blue	Purple
	Yellowiſh green	Blue
	Purpled red	Green
		Yellow
		Red
Order IV.	Green	Green
	Red	Red
Order V.	Faint green	Greeniſh blue
	Faint red	Red
Order VI.	Weak green	Greeniſh blue
	Light red	Red
Order VII	Very faint green	Greeniſh blue
	Very faint red.	Pale red.

“ When theſe coloured glaſſes were ſuſpended over the flame of a candle, the colours diſappeared ſuddenly, though the glaſſes ſtill continued to adhere to one another when they were parallel to the horizon. When they were ſuffered to cool, the colours returned by degrees to their former places, in the order of the preceding table.

“ After this the Abbe took two plates much thicker than the former, in order to obſerve at his leiſure the action of fire upon the matter which he ſuppoſed to produce the colours and obſerved, that as they grew warm, the colours retired to the edges of the glaſſes, and there became narrower and narrower till they were reduced to imperceptible lines. Withdrawing the flame, they returned to their place. This experiment he continued till the glaſſes were bent by the violence of the heat. It was pleaſant, he ſays, to obſerve theſe colours glide over the ſurface of the glaſs as they were purſued by the flame.

“ At the firſt, our author had no doubt but that theſe colours were owing to a thin plate of air between the glaſſes, to which Newton has aſcribed them; but the remarkable difference in the circumſtances attending thoſe produced by the flat plates, and thoſe produced by the object-glaſſes of Newton, convinced him that the air was not the cauſe of this appearance. The colours of the flat plates vaniſhed at the approach of flame, but thoſe of the object-glaſſes did not. He even heated the latter till that which was next the flame was cracked by the heat, before he could obſerve the leaſt dilatation of the coloured rings. This difference was not owing to the plane glaſſes being leſs compreſſed than the convex ones; for though the former were compreſſed ever ſo much by a pair of forceps it did not in the leaſt hinder the effect of the flame.

“ Afterwards he put both the plane glaſſes and the convex ones into the receiver of an air-pump, ſuſpending the former by a thread, and keeping the latter compreſſed by two ſtrings; but he obſerved no change in the colours of either of them in the moſt perfect vacuum he could make.

“ Notwithſtanding theſe experiments ſeemed to be concluſive againſt the hypotheſis of theſe colours being formed by a plate of air, the Abbe frankly acknowledges, that the air may adhere ſo obſtinately to the ſurface of the glaſſes as not to be ſeparated from them by the force of the pump; which, indeed, is agreeable to other appearances: but the following experiments of our author make it ſtill more improbable that the air ſhould be the cauſe of theſe colours.

"To try the utmoſt effect of heat upon theſe coloured plates, after warming them gradually, he laid them upon burning coals; but though they were nearly red, yet when he rubbed them together by means of an iron rod, he obſerved the ſame coloured circles and ovals as before. When he ceaſed to preſs upon them, the colours ſeemed to vaniſh; but when he repeated the friction, they returned, and continued till the pieces of glaſs began to be red-hot, and their ſurfaces to be united by fuſion.

"When the outward ſurface of one of his plates of glaſs was quickſilvered, none of thoſe colours were viſible, though the glaſſes continued to adhere with the ſame force. This he aſcribed to the ſtronger impreſſion made on the eye by the greater quantity of light reflected from the quickſilver.

"Judging from the reſemblance between his experiments and thoſe of Sir Iſaac Newton, that the colours were owing to the thickneſs of ſome matter, whatever that was, interpoſed between the glaſſes, the Abbe, in order to verify his hypotheſis, tried the experiment on thicker ſubſtances. He put between his glaſſes a little ball of ſuet, about a fourth of a line in diameter, and preſſed it between the two ſurfaces, warming them at the ſame time, in order to diſperſe the ſuet; but, though he rubbed them together as before, and uſed other ſoft ſubſtances beſides ſuet, his endeavours to produce the colours had no effect. But, rubbing them with more violence in a circular manner, he was ſurpriſed, on looking at a candle through them, to ſee it ſurrounded with two or three concentric rings, very broad, and with very lively delicate colours; namely, a red inclining to a yellow, and a green inclining to that of an emerald. At that time he obſerved only theſe two colours; but continuing the friction, the rings aſſumed the colours of blue, yellow, and violet, eſpecially when he looked through the glaſſes on bodies directly oppoſed to the ſun. If, after having rubbed the glaſſes, the thickneſs was conſiderably diminiſhed, the colours grew weaker by tranſmitted light, but they ſeemed to be much ſtronger by reflection, and to gain on one ſide what they loſt on the other.

14
Newtonian hypotheſis oppoſed.

"Our author was confirmed in his opinion, that there muſt be ſome error in Newton's hypotheſis, by conſidering, that, according to his meaſures, the colours of the plates varied with the difference of a millionth part of an inch; whereas he was ſatisfied that there muſt have been much greater differences in the diſtance between his glaſſes, when the colours remained unchanged.

"If the colour depended upon the thickneſs only, he thought that the matter interpoſed between the glaſſes ought to have given the ſame colour when it was reduced to a thin plate by ſimple fuſion as well as by friction, and that, in rubbing two plates together, warming them at different times, and compreſſing them with a conſiderable force, other colours would have appeared beſides thoſe abovementioned.

"Theſe circumſtances made him ſuſpect, that the different thickneſſes of the ſubſtance interpoſed between the glaſſes ſerved only to make them more or leſs tranſparent, which was an eſſential condition in the experiment; and he imagined that the friction diffuſed over the ſurface of the thin ſubſtance a kind of matter on which the colours are formed by reflected light: for when he held the plates (which gave the colours when the ſuet was between them) over the flame of a ſmall candle, the colours fled with great precipitation, and returned to their place without his being able to perceive the leaſt alteration in the ſuet.

"He was confirmed in his conjectures, by frequently obſerving, that when the glaſſes were ſeparated, at the moment the colours diſappeared, they were covered with the ſame greaſy matter, and that it ſeemed to be in the very ſame ſtate as when they were ſeparated without warming. Beſides, having often repeated the ſame experiment with different kinds of matter, he found that the degree of heat that diſperſed the colours was not always ſufficient to melt it; which difference was more ſenſible in proportion as the matter interpoſed was made thinner.

"Inſtead of the ſuet, he ſometimes made uſe of Spaniſh wax, reſin, common wax, and the ſediment of urine. He began with Spaniſh wax, on account of its remarkable tranſparency in Mr Hauksbee's electrical experiments; but he had much difficulty in making it ſufficiently thin by friction, being often obliged to warm his glaſſes, to ſeize the moment of fuſion, which continued but a ſhort time, and to hazard the burning of his fingers.

"The experiment at length ſucceeding, the Spaniſh wax appeared with its opacity and natural colour when it reflected the light, but they both diſappeared in the tranſmitted light. He obſerved the ſame rings in it as in the ſuet; and indeed he could perceive but little difference between the colours of ſuet, Spaniſh wax, common wax, or reſin; except that this laſt ſubſtance did not make the colours ſo vivid, on account of the too great tranſparency of its particles.

"The ſediment of urine had ſomething more particular in its appearance, as its colours were more lively. Holding it above the flame, its colours diſappeared; and, keeping it in that ſituation, there were formed, upon its ſurface, ramifications, like thoſe of the hoar-froſt, which diſappeared as the glaſſes grew cold. There were the ſame ramifications both upon the ſuet and the wax, but they were not ſo conſiderable. The glaſſes which had Spaniſh wax and reſin between them adhered with ſo much force, that they could not be ſeparated without the help of fire; and when they began to grow warm, they ſeparated with a noiſe like that of a glaſs breaking in the fire, though the glaſſes were not broken, and the matter between them was not melted.

"Separating the glaſſes which he firſt uſed very ſuddenly, he obſerved upon their ſurface very thin vapours, which formed different colours, but preſently vaniſhed altogether.

"To try the effect of vapour, he breathed upon one of his plates of glaſs, and obſerved that the vapours which adhered to the glaſſes ſometimes formed, before they were entirely diſperſed, a ſurpriſing variety of colours. This experiment, he obſerves, does not always ſucceed at the firſt trial. The glaſs muſt be breathed upon ſeveral times, and care muſt be taken to wipe it every time with one's hand, both to take off the moiſture, and alſo to make upon the glaſs a kind of furrows, which contribute very much to the variety of colours, by making inequalities in the thickneſſes of the vapours. It is neceſſary, alſo, that the glaſſes on which theſe experiments are made have no quickſilver upon them.

"When the particles of water which formed this vapour were too thick to exhibit theſe colours, he ſtruck them ſeveral times with his pencil, in order to attenuate them; and then he ſaw an infinity of ſmall coloured threads which ſucceeded one another with great rapidity.

"Putting a drop of water between two pieces of common glaſs, he obſerved that the compreſſion of them produced no colour; but if, while they were compreſſed, the water was made to paſs from one place to another, it left behind it large ſpots, red, yellow, green, purple, *&c.* and the ſpots aſſumed different colours with a ſurpriſing rapidity, and preſented to the eye a moſt beautiful variety of ſhades.

"In order to determine with greater certainty whether they were vapours that cauſed the colours in his firſt obſervations, he firſt breathed upon one of his plates of glaſs, and then rubbed them againſt one another, when the colours appeared in the ſame order as before, but darker, and diſperſed in confuſion in the places occupied by the vapours; but when he made uſe of fire to diſſipate the watery particles, the colours reſumed their luſtre.

"Newton, having introduced a drop of water between his two object glaſſes, obſerved, that in proportion as the water inſinuated itſelf between the glaſſes, the colours grew fainter, and the rings were contracted; and aſcribing theſe colours to the thickneſs of the plate of water, as he aſcribed the former to that of the plate of air, he meaſured the diameters of the coloured rings made by the plate of water, and concluded that the intervals between the glaſſes at the ſimilar rings of theſe two mediums were nearly as three to four; and thence he inferred, that, in all caſes, theſe intervals would be as the ſines of the refractions of theſe mediums.

"The Abbé Mazeas, in order to aſſure himſelf whether, agreeable to this rule, the coloured rings of his glaſſes depended upon the thickneſs of the water only, dipped one of the edges of his coloured glaſſes in a veſſel of water, having taken care to wipe and warm them well before he produced his colours by friction. The water was a conſiderable time in riſing as high as the glaſſes; and in proportion as it aſcended, he perceived a very thin plate of water, which ſeemed to paſs over the matter which he thought produced the colours, without mixing with it; for beyond this plate of water, he ſtill perceived the colours in the ſame place and order, but deeper and darker; and holding the glaſſes above the flame of a candle, he ſaw the colours go and come ſeveral times as he moved them nearer to or farther from the flame. He then moiſtened both the glaſſes more than before; and rubbing them as uſual, he always ſaw the ſame appearance; and ſeizing the moment when the colours had diſappeared to ſeparate the glaſſes, he always found that they were wet. On this account, he thought that it could not be the water on which the colour depended, but ſome ſubſtance much more ſenſible to heat. He alſo thought that theſe coloured rings could not be owing to the compreſſion of the glaſſes; or that, if this circumſtance did contribute any thing to them, it ſerved rather to modify than to generate them.

15 M. du Tour's obſervations.

"M. du Tour gave particular attention to the preceding obſervations of the Abbé Mazeas. He repeated the experiments with ſome variation of circumſtances, particularly comparing them with thoſe of Sir Iſaac Newton. He is ſo far from ſuppoſing a plate of air to be neceſſary to the formation of theſe coloured rings, that he thinks the reaſon of their not appearing between the flat plates of glaſs is the adhering of the air to their ſurfaces; and that mere preſſure is not ſufficient to expel it; except, as the Abbé Mazeas obſerved, the rings had before been made in the ſame place, in which caſe, ſimple appoſition without friction is ſufficient; the air, probably, not having had time to apply itſelf ſo cloſely to the ſurface of the glaſs. The contact of ſome other ſubſtances, M. du Tour obſerves, is not ſo prejudicial in this experiment as that of air; for he found, that, if he only gave the plates a ſlight coating of any kind of greaſe, the rings would appear without friction. Alſo dipping them ſlightly in water, or wiping them with his finger, would anſwer the ſame purpoſe. He verified his conjectures by means of the air-pump: for, dipping two pieces of glaſs in water, one of which had been wiped, and the other not, the former appeared to have no bubbles adhering to it when the air was exhauſted, whereas the other had.

"When one of the glaſſes is convex, our author obſerves, that the particles of air may more eaſily make their eſcape by preſſure only; whereas their retreat is in a manner cut off when they are compreſſed between two flat ſurfaces. The air-pump, he found, was not able to detach theſe particles of air from the ſurfaces to which they adhere; leaving theſe flat plates for a conſiderable time in an exhauſted receiver, was not ſufficient to prepare them ſo well for the experiment, as wiping them.

16 Experiments on colours by reflection.

"Beſides the obſervations on the colours of thin plates, it has been ſeen that Sir Iſaac Newton imagined he could account for the colours exhibited by thick ones in ſome caſes in a ſimilar manner; particularly in thoſe curious experiments in which he admitted a beam of light through a hole in a piece of paſteboard, and obſerved the rings of colours reflected back upon it by a concave glaſs mirror of equal thickneſs in all places. Theſe experiments were reſumed, and happily purſued, by the Duke de Chaulnes, who aſcribed theſe colours to the inflection of light*. Chance led the duke to obſerve, that when the nearer ſurface of the glaſs mirror was clouded by breathing upon it, ſo as lightly to tarniſh it, a white diffuſed and vivid light was ſeen upon the paſteboard, and all the colours of the rings became much ſtronger, and more diſtinct. This appearance he made conſtant by moiſtening the ſurface of the mirror with a little milk and water, and ſuffering it to dry upon it.

"In all his experiments upon this ſubject, he found, than when the rays fell converging on the ſurface of the mirror, the rings were hardly viſible; when they fell parallel upon it, as they muſt have done in all the experiments of Newton, they appeared ſufficiently diſtinct; but when, by means of a convex lens placed in the hole of the window, they were made to diverge from the centre of the ſphere to which the mirror was ground, ſo that they fell perpendicularly on the ſurface of the mirror, the colours were as vivid as he could make them. In this caſe he could remove the reflected image to a great diſtance from the hole, without making the rings diſappear; and he could plainly perceive them to ariſe from their central ſpots, which changed their colours ſeveral times.

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* See *Optics.*

"The effect of tarniſhing the mirror convinced him, that theſe coloured rings depended on the firſt ſurface of the mirror, and that the ſecond ſurface, or that which reflected them after they had paſſed the firſt, only ſerved to collect them and throw them upon the paſteboard in a quantity ſufficient to make them viſible, and he was confirmed in his ſuppoſition by the following experiments.

"He took a plano-convex object-glaſs, of ſix feet focus, and placed it ſix feet from the paſteboard with its convex ſide towards it. By this means the rays which fell upon that ſurface, after being refracted there, were tranſmitted through the thickneſs of the glaſs, parallel to one another, and fell perpendicularly on the plane ſurface that reflected them, and, in their return, would be collected upon the paſteboard. In theſe circumſtances the rings appeared very diſtinct after he had tarniſhed the convex ſurface, which in this poſition was next to the light.

"Turning the ſame glaſs the contrary way, ſo that the plane ſurface was towards the paſteboard, he could perceive none of the rings at the diſtance of ſix feet; but they were viſible at the diſtance of three feet: becauſe at that diſtance the ſecond ſurface reflected the rays by its concavity directly towards the paſteboard.

"Theſe two experiments demonſtrate the uſe of the ſecond ſurface of the mirror, and ſhow the manner of placing it to moſt advantage. Thoſe that follow ſhow the uſe of the firſt ſurface with reſpect to theſe rings; and he was led to make them by the caſual obſervation abovementioned.;

"Newton, he obſerves, had remarked, that when he made uſe of a mirror of the ſame focus with the firſt he had uſed, but of twice the thickneſs, he found the diameter of the rings much ſmaller than before. This obſervation the duke thought favourable to his own concluſions; for if theſe rings depend upon the firſt ſurface, the nearer it is to the ſecond, which only reflects the ray tranſmitted from it, the larger they ought to appear upon the paſteboard.

"To aſcertain this fact, he thought of making uſe of two moveable ſurfaces; and to make uſe of a micrometer to meaſure the diſtance between them with exactneſs. For this purpoſe he took a metallic mirror belonging to a reflecting teleſcope, being part of a ſphere of ten feet radius; and he fixed it firm upon a foot in which was a groove that carried a light frame, to which was faſtened a thin piece of talc tarniſhed with milk and water. The frame that ſupported the piece of talc could neither be brought into contact with the mirror, or be removed to the diſtance of eight or nine inches from it, and the micrometer ſhowed to the utmoſt exactneſs the leaſt motion of the frame.

"Having placed this mirror ten feet from the paſteboard, that is, at the diſtance of the radius of its own ſphere, he obſerved the rings to appear very diſtinct, the form of his mirror being very true: but the diameter of the rings upon the paſteboard varied with the diſtance of the talc from the mirror; ſo that they were very large when the talc was near the mirror, and very ſmall when it was placed at the diſtance of ſeven or eight inches.

"Theſe experiments proved, that the rings were formed by the firſt ſurface, and reflected by the ſecond; but it ſtill remained to be determined in what manner they were formed. He imagined, that the ſmall pencils of rays that were tranſmitted through the pores of the glaſs, or any other tranſparent ſubſtance, might ſuffer a kind of inflection, which might change the cylinder which they formed into a truncated cone, either by means of their different degrees of inflexibility, or by the different diſtances at which they paſs by the edges of the ſmall hole through which they are tranſmitted. Purſuing this idea, he thought of making uſe of ſome body, the pores of which were of a known and determined ſhape. Inſtead, therefore, of the piece of talc, he placed a piece of fine linen in the abovementioned frame, ſtretching it as even as poſſible, to make the pores formed by the threads more exact and more permeable by the light; and he ſoon found, with great pleaſure, that his conjecture was verified: for, inſtead of the circular rings which he had before, they were now manifeſtly ſquare, though their angles were a little rounded; and they were coloured as the others, though the light was not very vivid, on account of the quantity that was ſtopped by the muſlin.

"When, inſtead of the muſlin, he ſtretched acroſs his frame fine ſilver wires exactly parallel, at the diſtance of about three quarters of a line, or a whole line from one another, without any other wires acroſs them; inſtead of the rings which he had ſeen before, there was nothing upon the paſteboard but a gleam of white light divided by many ſmall ſtreaks, coloured in a very vivid manner, and in the ſame manner as the rings."

17
Another theory of colours.

Thus we have another hypotheſis of the formation of colours, namely, by the inflection of light in its paſſage out from between the ſolid and impenetrable particles of which bodies are compoſed. It is, however, very difficult, upon the hypotheſis either of Sir Iſaac Newton, or that of the Duke de Chaulnes, to give a reaſon why bodies that are not entirely white, ſhould not appear variouſly coloured. For, it appears from Sir Iſaac Newton's experiments, that plates of different denſity are capable of exhibiting the ſame colours; and that where a plate is continually varying in denſity, it will produce all the colours. Now it is evident, that the plates of which we ſuppoſe all natural bodies to be compoſed, muſt be ſimilar to one that is perpetually varying in its thickneſs; for ſuppoſing the plates of which any ſubſtance is compoſed to be of any determinate thickneſs, 9 millionth parts of an inch for inſtance; ſuch of the rays as are reflected from this plate will be red. But if any of them penetrate to the depth of $11\frac{1}{6}$ of theſe parts, they will be reflected of a violet colour, *&c.* and thus muſt alloy and obſcure the red; and ſo of others. If we ſuppoſe the colours to be produced by inflection, it will be equally difficult to account for ſome particular rays being inflected and others not; ſeeing we obſerve

ſerve that all of them are capable of being inflected by every ſubſtance whatever, when they paſs very near it. In ſome caſes too, colours are produced when the light is neither refracted nor inflected, as far as we can judge; and this ſeems to obſcure the theory of chromatics more than any thing we have yet mentioned.

As the experiments we are now about to mention are of the greateſt importance, and in direct terms contradict one of Sir Iſaac Newton's, we ſhall give a full account of them, from Prieſtley's hiſtory of Viſion, *&c.* with his remarks thereon.

18
One of Sir Iſaac Newton's experiments found to be erroneous

The experiment in queſtion is the eight of Newton's ſecond book of Optics: “ He (Sir Iſaac Newton) found, he ſays, that when light goes out of air through ſeveral contiguous refracting mediums, as through water and glaſs, and thence goes out again into air, whether the refracting ſurfaces be parallel or inclined to one another, that light, as often as, by contrary refractions, it is ſo corrected, that it emerges in lines parallel to thoſe in which it was incident, continues ever after to be white: but if the emergent rays be inclined to the incident, the whiteneſs of the emerging light will, by degrees, in paſſing on from the place of emergence, become tinged, at its edges with colours. This he tried by refracting light with priſms of glaſs, placed within a priſmatic veſſel of water.

“ By theorems deduced from this experiment, he infers, that the refraction of the rays of every ſort, made out of any medium into air, are known by having the refraction of the rays of any one ſort; and alſo, that the refraction out of one medium into another is found as often as we have the refractions out of them both into any third medium.

“ On the contrary, a Swediſh philoſopher (M. Klingenſtierna) obſerves*, that, in this experiment, the rays of light, after paſſing through the water and the glaſs, though they come out parallel to the incident rays, will be coloured; but that the ſmaller the glaſs priſm is, the nearer will the reſult of it approach to Newton's deſcription.

“ This paper of M. Klingenſtierna, being communicated to Mr Dollond by M. Mallet, made him entertain doubts concerning Newton's report of the reſult of his experiment; and determined him to have recourſe to experiments of his own.

“ He therefore cemented together two plates of parallel glaſs, at their edges, ſo as to form a priſmatic veſſel when ſtopped at the ends or baſes; and the edge being turned downwards, he placed in it a glaſs priſm with one of its edges upwards, and filled up the vacancy with clear water: ſo that the refraction of the priſm was contrived to be contrary to that of the water, in order that a ray of light, tranſmitted through both theſe refracting mediums, might be affected by the difference only between the two refractions. As he found the water to refract more or leſs than the glaſs priſm, he diminiſhed or increaſed the angle between the glaſs plates, till he found the two contrary refractions to be equal, which he diſcovered by viewing an object through this double priſm. For when it appeared neither raiſed nor depreſſed, he was ſatisfied that the refractions were equal, and that the emergent rays were parallel to the incident.

“ Now, according to the prevailing opinion, he obſerves, that the object ſhould have appeared through this double priſm in its natural colour; for if the difference of refrangibility had been in all reſpects equal, in the two equal refractions, they would have rectified each other. But this experiment fully proved the fallacy of the received opinion, by ſhowing the divergency of the light by the glaſs priſm to be almoſt double of that by the water; for the image of the object, though not at all refracted, was yet as much infected with priſmatic colours, as though it had been ſeen through a glaſs wedge only whoſe angle was near 30 degrees.

19
Colours produced without refraction or reflection.

“ This experiment is the very ſame with that of Sir Iſaac Newton abovementioned, notwithſtanding the reſult was ſo remarkably different: but Mr Dollond aſſures us, that he uſed all poſſible precaution and care in his proceſs; and he kept his apparatus by him, that he might evince the truth of what he wrote, whenever he ſhould be properly required to do it.

“ He plainly ſaw, however, that if the refracting angle of the water-veſſel could have admitted of a ſufficient increaſe, the divergency of the coloured rays would have been greatly diminiſhed, or entirely rectified; and that there would have been a very great refraction without colour, as he had already produced a great diſcolouring without refraction: but the inconveniency of ſo large an angle as that of the priſmatic veſſel muſt have been, to bring the light to an equal divergency with that of the glaſs priſm, whoſe angle was about 60°, made it neceſſary to try ſome experiments of the ſame kind with ſmaller angles.

“ Accordingly he got a wedge of plate-glaſs, the angle of which was only nine degrees: and, uſing it in the ſame circumſtances, he increaſed the angle of the water-wedge, in which it was placed, till the divergency of the light by the water was equal to that by the glaſs; that is, till the image of the object, though conſiderably refracted by the exceſs of the refraction of the water, appeared nevertheleſs quite free from any colours proceeding from the different refrangibility of the light.

20
Defences of Sir Iſaac.

“ Notwithſtanding it evidently appeared, I may ſay to almoſt all philoſophers, that Mr Dollond had made a real diſcovery of ſomething not comprehended in the optical principles of Sir Iſaac Newton, it did not appear to ſo ſenſible a man, and ſo good a mathematician, as Mr Murdoch is univerſally acknowledged to be. Upon this occaſion he interpoſed in the defence, as he imagined, of Sir Iſaac Newton; maintaining, that Mr Dollond's poſitions, which he ſays, he knows not by what miſhap have been deemed paradoxes in Sir Iſaac's theory of light, are really the neceſſary conſequences of it. He alſo endeavours to ſhow, that Sir Iſaac might not be miſtaken in his account of the experiment abovementioned. But admitting all that he advances in this part of his defence, Newton muſt have made uſe of a priſm with a much ſmaller refracting angle than, from his own account of his experiments, we have any reaſon to believe he ever did make uſe of.

“ The fact probably was, that Sir Iſaac deceived himſelf in this caſe, by attending to what he imagined to be the clear conſequences of his other experiments; and though the light he ſaw was certainly tinged with colours, and he muſt have ſeen it to be ſo, yet he might imagine that this circumſtance aroſe from ſome imperfection in his priſms, or in the diſpoſition of them, which he did not think it worth his while to examine. It is alſo obſervable, that Sir Iſaac is not ſo particular in his deſcription of his priſms, and other parts of his apparatus, in his account of this experiment, as he generally is in other caſes, and therefore probably wrote his account of it from his memory only.

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* *Swed. Abhand.* vol. 16. p. 300.

P. 804. “ Much has been ſaid on this experiment; and it is thought very extraordinary that a man of Sir Iſaac's accurate attention ſhould overlook a circumſtance, the effect of which now appears to be ſo conſiderable. But it has happily occurred to Mr Michell, that, as Sir Iſaac Newton obſerves he uſed to put ſaccharum ſaturni into his water to increaſe its refractive power, the lead, even in this form, might increaſe the diſſipative refraction, as it does in the compoſition of glaſs; and if ſo, that this would account for Newton's not finding the diſſipative power of water leſs than that of his glaſs priſms, which he otherwiſe ought to have done, if he had tried the experiment as he ſaid he did.

“ Accordingly he included a priſm of glaſs in water, as highly impregnated with ſaccharum ſaturni as it would bear, the proportion of ſaccharum to water being about as 5 to 11. When the image, ſeen through the water (ſo impregnated) and a glaſs priſm, was in its natural place, it ſtill was coloured, though very little: he thought not more than a fourth part as much as when ſeen through plain water, and the priſm in its natural place; ſo that he had no doubt, but that, if his priſm had had a little leſs of the diſperſing power, its errors would have been perfectly corrected.”

21
Mr Delaval's experiments on the colours of opaque bodies.

Beſides the experiments of Mr Delaval above related, and which were made on the colours of tranſparent bodies, he has lately publiſhed an account of ſome made upon the permanent colours of opaque ſubſtances; the diſcovery of which muſt be of the utmoſt conſequence in the arts of colour-making and dyeing. Theſe arts, he obſerves, were in very remote ages carried to the utmoſt height of perfection in the countries of Phoenicia, Egypt, Paleſtine, India, &c. and that the inhabitants of theſe countries alſo excelled in the art of imitating gems, and tinging glaſs and enamel of various colours. The colours uſed in very ancient paintings were as various as thoſe now in uſe, and greatly ſuperior both in beauty and durability. The paints uſed by Apelles were ſo bright, that he was obliged to glaze his pictures with a dark-coloured varniſh, leſt the eye ſhould be offended by their exceſſive brightneſs; and even theſe were inferior to what had been uſed among the ancient Egyptians. Pliny complains that the art of painting was greatly decayed in his time; and the moderns were not furniſhed with any means of retrieving the art until they began to avail themſelves of experimental obſervations.

22
Theſe colours depend chiefly on the diviſion of the colouring particles.

The changes of colour in permanently coloured bodies, our author obſerves, are produced by the ſame laws which take place in tranſparent colourleſs ſubſtances; and the experiments by which they can be inveſtigated conſiſt chiefly of various methods of uniting the colouring particles into larger, or dividing them into ſmaller maſſes. Sir Iſaac Newton made his experiments chiefly on tranſparent ſubſtances; and in the few places where he treats of others, acknowledges his deficiency of experiments. He makes the following remark, however, on thoſe bodies which reflect one kind of light and tranſmit another, viz. that “ if theſe glaſſes or liquors were ſo thick and maſſy that no light could get through them, he queſtioned whether they would not, like other opaque bodies, appear of one and the ſame colour in all poſitions of the eye; though he could not yet affirm it from experience.” It was the opinion of this great philoſopher, that all coloured matter reflects the rays of light, ſome reflecting the more refrangible and others the leſs refrangible rays more copiouſly; and that this is not only a true reaſon of theſe colours, but likewiſe the only reaſon. He was likewiſe of opinion that opaque bodies reflect the light from their anterior ſurface by ſome power of the body evenly diffuſed over and external to it. With regard to tranſparent coloured liquors, he expreſſes himſelf in the following manner: “ A tranſparent body which looks of any colour by tranſmitted light, may alſo look of the ſame colour by reflected light; the light of that colour being reflected by the farther ſurface of that body, or by the air beyond it: and then the reflected colour will be diminiſhed, and perhaps ceaſe, by making the body very thick, and pitching it on the back-ſide to diminiſh the reflection of its farther ſurface, ſo that the light reflected from the tinging particles may predominate. In ſuch caſes the colour of the reflected light will be apt to vary from that of the light tranſmitted.”

To inveſtigate the truth of theſe opinions Mr Delaval entered upon a courſe of experiments with tranſparent coloured liquors and glaſſes, as well as with opaque and ſemitranſparent bodies. From theſe he diſcovered ſeveral remarkable properties of the colouring matter; particularly, that in tranſparent coloured ſubſtances, it does not reflect any light; and when, by intercepting the light which was tranſmitted, it is hindered from paſſing through ſuch ſubſtances, they do not vary from their former colour to any other, but become entirely black (A).

23
No light reflected by the colouring particles.

This incapacity of the colouring particles of tranſparent bodies to reflect light, being deduced from very numerous experiments, may therefore be held as a general law. It will appear the more extenſive, if we conſider that, for the moſt part, the tinging particles of liquors or other tranſparent ſubſtances are extracted from opaque bodies; that the opaque bodies owe their colours to thoſe particles, in like manner as the tranſparent ſubſtances do: and that by the loſs of them they are deprived of their colours.

For making his experiments, Mr Delaval uſed ſmall vials

(A) Here our author obſerves, that he makes uſe of the word *colour* only to expreſs thoſe called *primary*; ſuch a mixture of them as does not compoſe whiteneſs, or any of the gradations between white and black, ſuch as are called by Sir Iſaac Newton, grey, dun, or ruſſet brown.

24 Apparatus for making theſe experiments.

vials of flint glaſs, whoſe form was a parallelopiped, and their height, excluſive of the neck, about two inches, the baſe about an inch ſquare, and the neck two inches in length. The bottom and three ſides of each of theſe vials was covered with a black varniſh; the cylindrical neck, and the anterior ſide, except at its edges, being left uncovered. He was careful to avoid any crevices in the varniſh. That no light might be admitted except through the neck or anterior ſide of the vials.

In theſe experiments it is of importance to have the vials perfectly clean; and as many of the liquors are apt to depoſit a ſediment, they ought to be put into the vials only at the time the experiments are to be made. The uncovered ſide of the vials ſhould not be placed oppoſite to the window through which the light is admitted: becauſe in that ſituation the light would be reflected from the farther ſide of the vial; and our author obſerves that ſmooth black ſubſtances reflect light very powerfully. But as it is a principal object in the experiment that no light be tranſmitted through the liquor, this is beſt accompliſhed by placing the uncovered ſide of the vial in ſuch a ſituation that it may form a right angle with the window.

25 The colouring matter only ſhows itſelf by tranſmitted light.

With theſe precautions our author viewed a great numbers of ſolutions, both of coloured metallic ſalts and of the tinging matter of vegetables; univerſally obſerving, that the colour by reflection was black, whatever it might be when viewed by tranſmitted light. If theſe liquors, however, are ſpread thin upon any white ground, they appear of the ſame colour as when viewed by tranſmitted light: but on a black ground they afford no colour, unleſs the black body be poliſhed; in which caſe the reflection of the light through it produces the ſame effect as tranſmiſſion.

The experiments with tinged glaſſes were in many reſpects analogous to thoſe with tranſparent coloured liquors. For theſe he made ſeveral parcels of colourleſs glaſs, principally uſing one compoſed of equal parts of borax and white ſand. The glaſs was reduced to powder, and afterwards ground, together with the ingredients by which the colours were imparted. "This method (ſays he) of incorporating the tinging particles is greatly preferable to mixing them with the raw materials; and the glaſſes thus compoſed excel moſt others in hardneſs, being ſcarcely inferior in luſtre to real gems."

The reſult of all the experiments made in this manner was, that when matter is of ſuch thinneſs, and the tinge ſo dilute, that light can be tranſmitted through it, the glaſſes then appear vividly coloured; but when they are in larger maſſes, and the tinging matter is more denſely diffuſed through them, they appear black; for theſe, as well as the tranſparent coloured liquors, ſhow their colour only by a tranſmiſſion. The following experiments were made with a view to determine the proportion of tinging matter which produces colour or blackneſs.

26 Experiments to determine the proportion of tinging matter.

1. Glaſs was tinged green by adding to it $\frac{1}{72}$th of its weight of copper; and that whether the latter was uſed in its metallic or calcined ſtate.

2. A blue glaſs was made by the addition of zaffre, a purple one by maganeſe, a red glaſs by gold, and yellow glaſſes by ſilver and calcined iron. A yellow glaſs reſembling a topaz was likewiſe made by the addition of a ſmall quantity of charcoal in powder. The ſame colour was likewiſe procured by the addition of wheat-flour, roſin, and ſeveral other inflammable matters. Small pieces of each of theſe glaſſes being ground by a lapidary, reſembled gems of their different colours.

3. Having formed pieces of ſuch glaſſes about two inches thick, he incloſed them in black cloth on all ſides except their farther and anterior ſurfaces. In this ſituation each of them ſhowed a vivid colour when light was tranſmitted through them; but when the poſterior ſurface was likewiſe covered with the cloth to prevent this tranſmiſſion, no other colour than black was exhibited by any of them.

4. When plates of tranſparent coloured glaſs, ſomewhat thicker than common window-glaſs, were made uſe of, they always exhibited their colours by tranſmitted light.

5. On intercepting the light tranſmitted through theſe coloured plates, they as conſtantly appeared black when placed in ſuch a direction as to form a right angle with the window.

From theſe phenomena Mr Delaval deduced the following obſervations: 1. That the colouring particles do not reflect any light. 2. That a medium, ſuch as Sir Iſaac Newton has deſcribed, is diffuſed over both the anterior and farther ſurfaces of the plates, whereby objects are equally and regularly reflected as by a mirror. Hence, when it is ſaid that light is reflected by the ſurface of any ſubſtance, it ſhould be underſtood from this expreſſion, that the reflection is effected by the medium diffuſed over its ſurface.

27 On the reflection of the light of a candle by coloured glaſſes.

6. When a lighted candle is placed near one of thoſe coloured plates, the flame is reflected by the medium which is diffuſed over the anterior ſurface. The image thus reflected entirely reſembles the flame in ſize and colour; being ſcarcely diminiſhed, and not in the leaſt tinged by the coloured glaſs.

7. If the plate be not ſo intenſely coloured, or ſo maſſy, as to hinder the tranſmiſſion of the light of the candle, there appears a ſecondary image of the flame, which is reflected by the medium contiguous to the farther ſurface of the glaſs; and as the light thus reflected paſſes through the coloured glaſs, it is tinged very vividly.

8 When the glaſs uſed in this experiment is of a green colour, the image of the flame is always of a bright green; and when glaſſes of other colours are uſed, that of a ſecondary flame is always the ſame with that of the glaſs.

9. The ſecondary image is leſs than that reflected from the anterior ſurface. This diminution is occaſioned by the loſs of that part of the light which is abſorbed in paſſing through the coloured glaſs. For whenever any medium tranſmits one ſort of rays more copiouſly than the reſt, it ſtops a great part of the different coloured rays. Much more light alſo is loſt in paſſing through coloured than tranſparent ſubſtances. In making theſe obſervations, it is proper to chooſe coloured plates of glaſs which are not in every part of an equal thickneſs, that the ſecondary image may not coincide with that reflected from the anterior ſurface, and be intercepted by it.

10. When the plates are ſo thick, and ſo copiouſly coloured, that the light cannot penetrate to their far-

ther

their ſurface, they appear intenſely black in whatever direction they are viewed, and afford no ſecondary image, but only reflect, from their anterior ſurface, the flame, or any other objects that are oppoſed to them. Theſe objects are repreſented in their own proper colours, and are as free from tinge as thoſe reflected from quickſilvered glaſs, or ſpecula made of white metals.

Hence again it is manifeſt, that the colouring particles do not poſſeſs any ſhare of reflective power; for if they had any ſhare in this reflection, they would certainly impart ſome ſhare of colour to the light they reflected. Hence alſo it appears, that tranſparent coloured bodies, in a ſolid ſtate, poſſeſs no more reflective power than thoſe in a fluid ſtate.

28
Experiments on the pure colouring particles.

Our author next conſiders the colouring particles themſelves, pure, and unmixed with other media. In order to procure maſſes made up of ſuch particles, ſeveral tranſparent coloured liquors were reduced to a ſolid conſiſtence by evaporation. By employing a gentle heat, the colouring matter may thus remain unimpaired; and is capable of having its particles again ſeparated by water or other liquids, and tinging them as before.

In this ſtate the colouring particles reflect no light, and therefore appear uniformly black, whatever ſubſtance they have been extracted from. In the courſe of his experiments, Mr Delaval made uſe of the infuſions of brazil wood, logwood, fuſtic, turmeric, red ſaunders, alkanet, ſap-green, kermes, and all the other tranſparent coloured liquors he had tried before, among which were infuſions of red and yellow flowers, without obſerving the leaſt variation in the reſult.

Some liquors are apt to become totally opaque by evaporation: the reaſon of which may be the cryſtallization of ſaline matters, or the coaleſcence of the particles into maſſes, differing conſiderably in denſity from the menſtrua in which they were diſſolved. When this opacity takes place, our author has conſtantly obſerved, that they become incapable of entering the pores of wool, ſilk, or other matters of that kind, or of adhering to their ſurface; and conſequently unfit for the purpoſes of dyeing. This he ſuppoſes to ariſe from their increaſed bulk; for the attractive force by which the particles cohere together is weakened in proportion as their bulk increaſes: ſo that the degree of magnitude of the colouring particles, which is eſſential to the opacity of liquors, is inconſiſtent with the minuteneſs requiſite for dyeing. An inſtance of this is given in an infuſion of fuſtic. Having infuſed ſome of this wood in ſuch a quantity of water, that the latter was ſaturated with the colouring particles, he evaporated the liquor to a ſolid conſiſtence with an uninterrupted, but very gentle heat. During every part of the proceſs the liquor continued tranſparent, and the ſolid extract yielded by it tranſmitted a yellow colour when ſpread thin, but appeared black when thicker maſſes were viewed. Having prepared another pint of this liquor, he evaporated half the water, and allowed the remainder to become cold. In this ſtate it became turbid and opaque; on filtering, a tranſparent tincture paſſed through an opaque fecula remaining on the paper. This fecula did not adhere to the paper, but was eaſily ſeparable from it: on being dried, it appeared white with a ſlight tinge of yellow; but was nevertheleſs ſoluble in water, and by ſolution gave a liquid in all reſpects ſimilar to the original infuſion. "From theſe circumſtances (ſays he) it appears that a given proportion of water, or a ſufficient degree of heat, is requiſite to the ſolution of the colouring particles of fuſtic. And experience evinces, that thoſe particles which are too groſs to paſs through filtering paper, are incapable of entering the pores or firmly cohering to the ſurface of bodies. Many ingredients, ſuch as the colouring particles of logwood, kermes, and various other matters, are ſoluble in water in every proportion; and therefore their infuſions are not ſubject to become opaque or turbid during their evaporation. The ſolid extracts obtained by evaporation reflect no colour, but are black.

Our author alſo formed ſolid maſſes by mixing a ſmall quantity of drying oil with pigments which conſiſt chiefly of colouring matter; as Pruſſian blue, indigo, and ſap-green. Theſe paints likewiſe exhibit their reſpective colours only by tranſmitted light; appearing entirely black when viewed by reflection. Inſtances of blackneſs ariſing from this denſity of the colouring matter may be obſerved in ſeveral kinds of fruits, as black currants, cherries, &c. for the juices of theſe appear red when ſpread thin on a white ground, or otherwiſe viewed by tranſmitted light.

Mr Delaval's next attempt was to conſider the action and properties of the colouring particles of opaque bodies themſelves, and the means by which theſe colours are produced. Here our author endeavours to prove, that theſe colours of opaque bodies appear on the ſame principles as thoſe already mentioned, which ſeem black when very denſe, but ſhow their proper tinge when ſpread thin upon a white ground. On this ſubject the following experiments were made.

1. Graſs, and other green leaves of plants, were digeſted in rectified ſpirit of wine, by which means a tranſparent green tincture was obtained. One of the vials formerly mentioned being filled with this liquid, it was obſerved to tranſmit a vivid green colour; but the other part of the tincture, which was contiguous to the uncovered ſide of the vial, reflected no light, and therefore appeared black.

2. Having poured ſome of the tincture into a China cup, the bottom was thereby made to look green, exactly reſembling the colour which had been extracted from the leaves.

3. After the colour had been totally abſtracted by the vinous ſpirit, the leaves remained apparently unaltered, either as to figure or texture; but were entirely white, or had their whiteneſs ſlightly tinged with brown.

4. Red, purple, and blue flowers, were alſo digeſted in ſpirit of wine; all of which yielded their colouring matter to the ſpirit, and became white by being deprived of it. From moſt of theſe flowers, however, the ſpirit acquired either no tinge at all, or only a very faint one; but when acidulated, it became red, and by the addition of an alkali appeared blue, purple, or green, according to the quantity of alkali and the nature of the infuſion. In theſe ſtates, all of them, when

viewed by tranſmitted light, or poured upon a white ground, ſhowed their colours, but univerſally appeared black by reflection.

5. Red, purple, and blue flowers, were digeſted in water ſlightly acidulated with nitrous acid. Thus, red infuſions were obtained, which, by ſaturation with ſea ſalt, might be preſerved for many years.

6. The ſame liquors were changed, green, blue, or purple, by the addition of an alkali: but here the caſe was the ſame as before; all of them yielding vivid colours by tranſmiſſion, but none by reflection. In making this experiment, care muſt be taken to add the alkali very gradually; for if too much is put in at once to the red liquor, the intermediate colours between the red and the green will be wanting. To half an ounce of the red infuſion it is proper to add, at once, only the ſmalleſt quantity that can be taken up on the point of a pen; repeating this addition ſlowly, until each of the colours be produced.

7. The flowers, after having been repeatedly macerated in acidulated water, loſt their colouring matter, and became white.

8. Yellow flowers alſo communicated their colours to water and to ſpirit of wine. The infuſions and tinctures of theſe flowers were ſubjected to the ſame experiments as had been employed in the examination of the liquors already mentioned; and appeared yellow by tranſmitted light, but did not reflect any colour.

9. White paper, linen, &c. may be tinged of any of theſe colours, by dipping them in the infuſions; and the conſideration of the manner in which the colours are imparted to the linen, affords much inſight into the manner in which natural colours are produced. It has already been obſerved, that, when the colouring matter of plants is extracted from them, the ſolid fibrous parts, thus diveſted of their covering, diſplay their natural whiteneſs. White linen, paper, &c. are formed of ſuch fibrous vegetable matter; which is bleached by diſſolving and detaching the heterogeneous colouring particles. When theſe are dyed or painted with vegetable colours, it is evident that they do not differ in their manner of acting on the rays of light from natural vegetable bodies; both yielding their colours by tranſmitting, through the tranſparent coloured matter, the light which is reflected from the white ground. This white matter frequently exiſts, without any conſiderable mixture, in plants, while they are in a ſtate of vegetation; as cotton, white flowers, the pith, wood, ſeeds, roots, and other parts of ſeveral kinds of vegetables. When decayed trees, &c. have been long expoſed to the atmoſphere, their coloured juices are ſometimes ſo perfectly extracted, that the fibres appear white. This white matter is not diſtinct from the vegetable earth to which plants are reduced by burning †. Mr Delaval has rendered aſhes intenſely white, by carefully calcining them, and afterwards grinding with a ſmall proportion of nitre, and expoſing them to ſuch a degree of heat as would cauſe the nitre deflagrate with the remaining quantity of phlogiſton. Laſtly, the aſhes were digeſted with marine acid, in order to diſſolve the ferruginous matter diffuſed through them, and repeatedly waſhing the remainder in water. Mixing aſhes thus purified with borax, and applying a vitrifying heat, an opaque enamel is obtained, remarkable for its whiteneſs.

29 How aſhes may be made intenſely white.

30 White earth of plants, the only ſubſtance in them that reflects the light.

Hence it appears, that the earth which forms the ſubſtance of plants is white, and ſeparable from that ſubſtance which gives to each its peculiar colour; that whenever it is pure and unmixed, or diffuſed through colourleſs media, it ſhows its native whiteneſs; and is the only vegetable matter endowed with a reflective power. It may be diſcovered, however, by other means than that of burning: thus, roſes may be whitened by expoſing them to the vapour of burning ſulphur; an effect which cannot be attributed to the vitriolic acid, but to the phlogiſton contained in that vapour. This was proved to be the caſe, by expoſing ſeveral kinds of red and purple flowers to the phlogiſtic vapour iſſuing from hepar ſulphuris; and by this every one of them was whitened; their colour being afterwards reſtored by the addition of an acid either mineral or vegetable.

31 Colouring matter diſſolved by phlogiſton.

"Thus (ſays Mr Delaval) it appears, that the colouring matter of the flowers is not diſcharged or removed, but only diſſolved by the phlogiſton; and thereby divided into particles too minute to exhibit any colour. In this ſtate, together with the vegetable juice in which they are diffuſed, they form a colourleſs tranſparent covering, through which the white matter of the flowers is ſeen untinged. The colouring particles of plants conſiſt principally of inflammable matter; and their ſolubility in phlogiſton, and union with it, are analogous to the action of other inflammable bodies upon each other. Thus, ether diſſolves all eſſential and expreſſed oils, animal empyreumatic oils, and reſins. Sulphur, camphor, and almoſt all ſubſtances abounding in phlogiſton, are ſoluble in oils, ardent ſpirits, or other inflammable menſtrua. The manner in which the red colour of vegetable flowers is reſtored, appears to be explicable from known chemical laws. When acids are applied to the whitened flowers, they unite with the phlogiſton which the ſulphur had communicated, and diſengage it from the colouring particles; which, being thus extricated, reſume their original magnitude and hue. A change of the ſame kind is alſo produced by fixed alkali, which, like the acids, has a ſtrong attraction for phlogiſton, always changes the whitened flowers to a blue, purple, or green colour.

32 Colours deſtroyed by the light of the ſun.

"In like manner, the action of the rays of light operates upon coloured bodies. Thus, dyed ſilk, or other ſubſtances of that kind, when expoſed to the ſun's light, are deprived of their colour in every part on which the rays are allowed to act; whilſt thoſe preſerve their colour which are defended from the light by the folds of the cloth, or intervention of any opaque body. The colours, thus impared, may be reſtored if acids are applied while the injury is recent; but they are afterwards apt to fly off, on account of that volatility which is conſtantly imparted by inflammable matter to any other with which it is united."

Our author now proceeds, at conſiderable length, to prove the identity of the ſolar light and phlogiſton: but as recent experiments have ſhown that theſe two are eſſentially diſtinct, we omit his argumentation upon this head. The error of his theory in this reſpect, however, does not in the leaſt affect the doctrine concerning colours above laid down: on the contrary, the lateſt experiments have determined, that phlogiſton, in its groſſeſt form, *viz.* that of common charcoal, manifeſts a ſurpriſing power of whitening various ſubſtances; which, according to Mr Delaval's theory, proceeds from the power it has of diſſolving the colouring matter with which they are impregnated. This ſolvent power, according to our author, is manifeſt in many other inſtances beſides thoſe already mentioned. Silk is whitened by the phlogiſtic vapours of ſulphur: and this operation does not appear to differ from the change effected on flowers by the ſame vapour. The light of the ſun is found to be a neceſſary and eſſential agent in bleaching linen, wax, and various other ſubſtances; ſome part of the colouring matter which impairs the whiteneſs of theſe bodies not yielding to any other ſolvent. Red flowers are whitened by the electric ſpark, of whoſe inflammable nature we cannot entertain the leaſt doubt; for the ſpark itſelf is a bright flame, and yields the ſame ſmell which all other phlogiſtic matters impart. The electric ſpark, in like manner, changes the blue infuſion of turnſole to red (B). The effects which it produces on the turnſole, and on red flowers, do not differ from each other, except in degree only. For when vegetable matter is diſſolved, it is changed from blue to red; and, when farther diſſolved, it is divided into particles too minute to exhibit any colour.

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† See *Chemiſtry-Index.*

33
How to diſtinguiſh the ſolutions made by phlogiſton from thoſe made by acids.

Solutions effected by means of phlogiſton frequently are wrongly attributed to the operation of ſuppoſed acid menſtrua, as ſeveral kinds of ſubſtances are capable of being diſſolved indiſcriminately both by acids and phlogiſton. For the purpoſe of diſtinguiſhing, therefore, in any caſe between the action of the acid ſolvents and that of the inflammable menſtrua, it is proper to examine the nature of the matter by which either of theſe principles are furniſhed. It appears from various chemical proceſſes, that alkalies are rendered mild, and capable of cryſtallization, in proportion as they are united to phlogiſton. The phlogiſticated alkaline lixivium, when ſaturated, is perfectly mild; and by a ſlight evaporation is reduced to a concrete cryſtalline maſs, which does not deliqueſce or imbibe the leaſt moiſture from the air, and no longer retains any alkaline property. M. Beanmé by an elegant and ingenious experiment, has proved the preſence of phlogiſton in mild alkalies, and has ſhown that their power of cryſtallizing depends upon their union with that principle. He heated in a ſilver veſſel a lixivium of mild alkali, which imparted to the ſilver a covering or coating of inflammable matter, by which its ſurface was tarniſhed and became black. The lixivium was ſeveral times poured out of the ſilver veſſel; and after the ſurface of the metal had been freed from the tarniſh, the lixivium was replaced in it, and again heated, by which the tarniſh was renewed. and this was repeated till the lixivium no longer communicated any ſtain to the ſilver. The cauſticity of the lixivium was increaſed in proportion as it imparted its phlogiſton to the ſilver; and at the end of the proceſs the alkali became perfectly cauſtic, and incapable of cryſtallizing.

Our author now goes on to prove, that fixed air is not an acid, nor a compound of air and phlogiſton, as is now generally believed, but rather entirely of a phlogiſtic nature. For an account of his arguments in favour of this opinion, ſee the article FIXED AIR: here we ſhall only conſider his farther experiments on colours.

"From the preceding experiments (ſays he) it appears, that the colouring particles of flowers and leaves are ſoluble in acid, alkaline, and phlogiſtic menſtrua. The other parts of vegetables conſiſt of materials ſimilar to thoſe which are contained in their flowers and leaves, and undergo the ſame changes from the ſame cauſes. Having extracted from logwood its colouring particles by repeatedly boiling it in water, the wood was thus deprived of its yellow colour, and aſſumed a brown hue ſimilar to that of oak-wood. Some pieces of it thus deprived of its colour were then macerated in aquafortis; and after they had undergone the action of that acid, they were waſhed in a ſufficient quantity of water. The wood was thus reduced to whiteneſs."

34
Logwood affords only a yellow tincture with water.

Here our author obſerves, that though moſt authors who treat of colouring ſubſtances deſcribe logwood as of a red colour, he was never able to procure any other colour from it but yellow. It imparts yellow and orange colours to diſtilled water. Other waters extract a red tinge from it by means of the alkali which they contain. Theſe obſervations are alſo applicable to the other dyeing woods, kermes, and various other articles of the materia tinctoria. By a ſimilar treatment, fuſtic wood alſo loſt its colouring matter, and became white.

The reſults of all the experiments above related are, that the colouring matter of plants does not exhibit any colour by reflection, but by tranſmiſſion only; that their ſolid earthy ſubſtance is a white matter; and that it is the only part of vegetables which is endowed with a reflective power; that the colours of vegetables are produced by the light reflected from this white matter, and tranſmitted from thence through the coloured coat or covering which is formed on its ſurface by the colouring particles; that whenever the colouring matter is either diſcharged or divided by ſolution into particles too minute to exhibit any colour, the ſolid earthy ſubſtance is expoſed to view, and diſplays that whiteneſs which is its diſtinguiſhing characteriſtic.

34
Colouring matter of animal ſubſtances.

Mr Delaval next proceeds to examine the coloured parts of animal ſubſtances, and finds them exactly ſimilar, with regard to the manner in which the colour is produced, to the vegetable bodies already treated of. The tinctures and infuſions of cochineal and of kermes yield their colours when light is tranſmitted through them, but ſhow none by reflection. On diluting freſh ox-gall with water, and examining it in the phials already mentioned, that part of it which was in the neck of the phial, and viewed by tranſmitted light, was yellow; but the anterior ſurface was black, and reflected no colour. Fleſh derives its colour entirely from the blood, and when deprived of it the fibres and veſſels are perfectly white; as are likewiſe the membranes

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(B) This effect of the electric ſpark is now known to be produced, not by its phlogiſtic nature, but by the generation of an acid.

branes, ſinews, and bones, when freed from their aqueous and volatile parts; in which caſe they are a mere earth, unalterable by fire, and capable of imparting an opaque whiteneſs to glaſs.

35 Of the colour of blood. On examining blood diluted with water in one of the phials formerly deſcribed, it tranſmitted a red colour, and the anterior ſurface was almoſt, but not entirely, black; for it received a ſlight hue of brown from ſome coagulated particles that were ſuſpended in the liquor. In order to procure blood ſufficiently diluted, and at the ſame time equably and perfectly diſſolved, he mixed as much cruor with ſpirit of ſal ammoniac as imparted a bright colour to it. The liquor being then viewed in the phial, that part which was contained in the neck, and tranſmitted the light, appeared of a fine red; but the anterior part reflecting no light, was intenſely black. Hence it appears, that the florid red colour of the fleſh ariſes from the light which is reflected from the white fibrous ſubſtance, and tranſmitted back through the red tranſparent covering which the blood forms on every part of it.

Blood, when recently drawn, does not aſſume the appearance common to tranſparent coloured liquors; for theſe, when too maſſy to tranſmit light from their farther ſurfaces, always appear black; but blood, when recently drawn, always ſhows a fine red colour, in whatever way it be viewed. This is occaſioned by a white matter diffuſed through the blood; and which is eaſily ſeparated from the cruor, by dividing it after coagulation into a number of thin pieces, and waſhing in a ſufficient quantity of pure water. Thus the water acquires a red colour, and ought to be changed daily. In a few days it will acquire no more tinge; and the remaining maſſes of the cruor are no longer red, but white.

36 Of the ſhells of lobſters. In like manner, the red colour of the ſhells of lobſters, after boiling, is no more than a mere ſuperficial covering ſpread over the white calcareous earth of which the ſhells are compoſed, and may be eaſily removed from the ſurface by ſcraping or filing. Before the application of heat, this ſuperficial covering is much denſer; inſomuch that, in ſome parts of the ſhell, it appears quite black, being too thick to admit the paſſage of the light to the ſhell and back again; but where this tranſparent blue colour of the unboiled lobſter is thinner, it conſtantly appears like a blue film. In like manner, the colours of the eggs of certain birds are entirely ſuperficial, and may be ſcraped off, leaving the white calcareous earth expoſed to view.

37 Of feathers. The caſe is the ſame with feathers, which owe their colours entirely to a very thin layer of ſome tranſparent matter upon a white ground. Our author aſcertained this by ſcraping off the ſuperficial colours from certain feathers which were ſtrong enough to bear the operation; and thus ſeparated the coloured layers from the white ground on which they had been naturally ſpread. The lateral fibres of the feathers cannot indeed have their ſurfaces ſeparated in this manner; but their texture, when viewed by a microſcope, ſeems to indicate, that the colours are produced on them by no other means than thoſe already related. In the examination of ſome animal ſubjects where the colouring matter could not be ſeparated by chemical means, our author had recourſe to mechanical diviſion; but this can only be employed when the principal part of the white ſubſtance is unmixed with the coloured coat or covering which is ſpread upon its ſurface. All of them, however, by whatever means their colours could be ſeparated, ſhowed that they were produced in the ſame manner, namely, by the tranſmiſſion of light from a white ground through a tranſparent coloured medium.

38 Of the colours of mineral ſubſtances. The coloured ſubſtances of the mineral kingdom are very numerous, and belong principally to two claſſes, *viz.* earths and metals. The former, when pure, are all perfectly white, and their colours ariſe from phlogiſtic or metallic mixtures. Calcareous earths, when indurated, conſtitute marble, and may be tinged with various colours by means of metallic ſolutions; all which are ſimilar in their nature to the dyes put upon ſilk, cotton, or linen, and invariably proceed from the ſame cauſe, *viz.* the tranſmiſſion of light through a very thin and tranſparent coloured medium. Flints are formed from ſiliceous earth, and owe their colour to phlogiſton. When ſufficiently heated, they are rendered white by the loſs of the inflammable matter which produced their colour. When impregnated with metals, they form agates, cornelians, jaſper, and coloured cryſtals. The coloured gems alſo receive their different hues from metals; and all of them may be imitated by glaſſes tinged with ſuch phlogiſtic or metallic matters as enter into the compoſition of the original ſubſtances.

39 Of metals. Thus our author concludes, that the coloured earths, gems, &c. exhibit their various tints in the ſame manner with other ſubſtances; *viz.* by the tranſmiſſion of light reflected from a white ground. Our author, however, proceeds farther; and aſſerts, that even the colours of metals themſelves are produced in the ſame manner.

"Gold (ſays he) exhibits a white light, which is tinged with yellow. I have uſed this expreſſion, becauſe it appears from experiment that gold reflects a white light, and that its yellow colour is a tinge ſuperadded to its whiteneſs. The experiment is thus ſet forth by Sir Iſaac Newton. Gold in this light (that is, a beam of white light) appears of the ſame yellow colour as in day light; but by intercepting at the lens a due quantity of the yellow-making rays, it will appear white like ſilver, as I have tried; which ſhows, that its yellowneſs ariſes from the exceſs of the intercepted rays, tinging that whiteneſs with their colour when they are let paſs.

"I have already ſhown, by numerous experiments, in what manner coloured tinges are produced; and it uniformly appears, from all theſe experiments, that colours do not ariſe from reflection, but from tranſmiſſion only. A ſolution of ſilver is pellucid and colourleſs. A ſolution of gold tranſmits yellow, but reflects no colour. This metal alſo, when united with glaſs, yields no colour by reflection, but by tranſmiſſion only. All theſe circumſtances ſeem to indicate, that the yellow colour of gold ariſes from a yellow tranſparent matter, which is a conſtituent part of that metal; that it is equally mixed with the white particles of the gold, and tranſmits the light which is reflected by them, in like manner as when ſilver is gilt, or foils are made by covering white metals with tranſparent colours. But theſe factitious coverings are only ſuperficial; whereas the yellow matter of gold is diffuſed throughout the whole ſubſtance of the metal, and appears to envelope, and cover each of the white particles. In whatſoever manner the yellow matter of gold is united to its white ſubſtance, it exiſts in a rare ſtate; for it bears only the ſame proportion to the white particles of the gold as that of the yellow-making rays which were intercepted bears to all the other rays compriſed in the white light of the ſun.

"Sir Iſaac Newton has ſhown, that when ſpaces or interſtices of bodies are replenished with media of different denſities, the bodies are opaque; that thoſe ſuperficies of tranſparent bodies reflect the greateſt quantity of light which intercede media that differ moſt in their refractive denſities; and that the reflections of very thin tranſparent ſubſtances are conſiderably ſtronger than thoſe made by the ſame ſubſtances of a greater thickneſs. Hence the minute portions of air, or of the rarer medium, which occupies ſpaces void of other matter, reflect a vivid white light whenever their ſurfaces are contiguous to media whoſe denſities differ conſiderably from their own; ſo that every ſmall maſs of air, or of the rarer medium, which fills the pores or interſtices of denſe bodies, is a minute white ſubſtance. This is manifeſt in the whiteneſs of froth, and of all pellucid colourleſs bodies; ſuch as glaſs, cryſtal, or ſalts, reduced to powder, or otherwiſe flawed; for in all theſe inſtances a white light is reflected from the air or rarer medium which intercede the particles of the denſer ſubſtances whoſe interſtices they occupy."

From theſe principles our author takes occaſion to explain the reaſon why the particles of metals which yield no colour by incident light when ſuſpended in their ſolvents, are diſpoſed to exhibit colours when ſeparated from them. Hence alſo we ſee why opaque white ſubſtances are rendered pellucid by being reduced to uniform maſſes whoſe component parts are every where nearly of the ſame denſity; for as all pellucid ſubſtances are rendered opaque and white by the admixture of pellucid colourleſs media of conſiderably different denſities, they are again deprived of their opacity by extricating theſe media which kept their particles at a diſtance from each other: thus froth or ſnow, when reſolved into water, loſe their whiteneſs, and aſſume their former pellucid appearance. In like manner, by proper fluxes, the opaque white earths are reduced to pellucid colourleſs glaſſes; becauſe all reflections are made at the ſurfaces of bodies differing in denſity from the ambient medium, and in the confines of equally denſe media there is no reflection.

As the calces of metals are enabled to reflect their colours by the intervention of the particles of air; ſo, when mixed with oil in the making of paints, they always aſſume a darker colour, becauſe the exceſs of the denſity of oil over that of air forms a ſenſible difference when comparatively conſidered with reſpect to the ſpecific gravity of the rarer metals. From this cauſe perceptibly leſs light is reflected from the moleculæ of oil than from thoſe of air, and conſequently the maſs appears darker. The caſe, however, is different with ſuch paints as are formed of the denſer metals; as vermilion, minium, &c.: for though oil differs very conſiderably from air in its ſpecific denſity, yet it alſo differs very much in this reſpect from the denſer metallic powders; and the moleculæ of oil which divide their particles act upon the light ſo ſtrongly, that the reflection occaſioned by them cannot be diſtinguiſhed from thoſe which are cauſed by rarer media. Hence, though we mix vermilion or minium with oil, the colour is not ſenſibly altered.

40
Objections to his theory of metallic colours.

This part of our author's theory, however, ſeems liable to objection: for though it be true that the calces of ſome metals are denſer than others, yet that is, comparatively ſpeaking, but in a very ſmall proportion; nor is even the difference of denſity between oil and the calces of the heavier metals at all comparable to that between the denſity of air and oil. Thus, tho' the calx of iron may be 10 or 11 times more denſe than oil; yet, as the latter is between 500 and 600 times denſer than air, the ſmall difference between the oil and metallic calx ought to be imperceptible. In this reſpect, indeed, there are conſiderable differences with regard to the oils employed, which cannot be ſuppoſed to ariſe from the mere circumſtance of denſity. Thus the colour of vermilion, when mixed with turpentine-varniſh, is much brighter than with linſeed-oil; and yet the difference between the denſities of linſeed-oil and turpentine-varniſh is very trifling. The mere action of heat likewiſe has a ſurpriſing effect in this caſe. Thus the red calx of iron, called *ſcarlet oker*, by being only heated a certain degree, appears of a very dark purple, reſuming its red colour when cold; and this variation may be induced as often as we pleaſe by only heating it over the fire in a ſhovel. In like manner, by gradually heating red lead, it may be made to aſſume a moſt beautiful crimſon colour; which growing gradually darker, becomes at laſt almoſt quite black. On cooling, if the heat has not been raiſed too high, it gradually returns through the ſame ſhades of colour, until at laſt it fixes in its original hue. Theſe immenſe differences in colour cannot by any means be attributed either to the expulſion of air or to an alteration in denſity. The fire indeed does certainly expand theſe calces as well as other bodies; but as the medium interſperſed between their particles is thus alſo expanded, the colour ought at leaſt to remain the ſame, if not to become lighter, on account of the ſuperior expanſion of air to that of metal by the ſame degree of heat. It would ſeem, therefore, that the action of the element of fire itſelf has a conſiderable ſhare in the production of colours; and indeed its ſhare in the operations of nature is ſo great, that we might well think it ſtrange if it ſhould be entirely excluded from this.

41
Of the colours of ſemipellucid ſubſtances.

With regard to ſemipellucid ſubſtances, which appear of one colour by incident and another by tranſmitted light, our author likewiſe endeavours to ſhow, that no reflection is made by the coloured matter, but only by the white or colourleſs particles. They conſiſt of pellucid media, throughout which white or colourleſs opaque particles are diſperſed. The latter are diſpoſed at ſuch diſtances from each other, that ſome of the incident rays of light are capable of paſſing through the intervals which intercede them, and thus are tranſmitted through the ſemipellucid maſs. Some ſorts of rays penetrate through ſuch maſſes, while others which differ from them in their refrangibility are reflected by the white or colourleſs particles; and from thence are tranſmitted through the pellucid part of the medium which intervenes between the reflecting particles and the anterior ſurface of the maſs. On the ſame principle our author explains the blue colour of

42 How colours are ſhown by tranſmitted light

the ſky, the green colour of the ſea, and other natural phenomena: and from his numerous experiments on this ſubject at laſt concludes, that the power by which the ſeveral rays of light are tranſmitted through different media is inherent in the particles themſelves, and therefore is not confined to the ſurfaces of ſuch media. For if the tranſmiſſive force was exerted at the ſurface only, the thinner plates of coloured ſubſtances would act upon the rays as powerfully as thicker maſſes. But it appears from experiment, that in proportion as the rays paſs through different thickneſſes of coloured media, they exhibit colours differing not only in degree, but frequently in ſpecies alſo.

"The ſun's light, by which bodies are illuminated, conſiſts of all the rays by which a white light is compounded. Theſe rays, in their entire and undivided ſtate, are incident upon the opaque particles of ſemipellucid ſubſtances, and upon the colouring particles of tranſparent coloured ſubſtances, whenever theſe media are expoſed to the light. When the rays accede to the opaque particles of ſemipellucid ſubſtances, ſome ſorts of them are reflected back from the anterior ſurface of thoſe particles: the other ſorts of rays, which are not reflected back, are diverted from the direction which is oppoſite to the anterior ſurface of the opaque particles, and paſſing through the intervals between the particles, are tranſmitted through the maſs.

"When the rays are incident upon the particles of tranſparent coloured bodies, none of them are reflected back; becauſe the colouring particles are not endowed with any reflective power: but ſome of the rays are either ſtopped at the anterior ſurface of the particles, or are diverted into ſuch directions as render them incapable of paſſing towards the farther ſide of the maſs; and conſequently ſuch rays cannot be tranſmitted. The rays which are not thus intercepted or diſperſed, are tranſmitted in the ſame manner as thoſe which paſs through ſemipellucid media. Thus it is evident, that the coloured rays which are tranſmitted through ſemipellucid ſubſtances are *inflected* by the opaque particles: and thoſe which are tranſmitted through tranſparent-coloured ſubſtance are *inflected* by the colouring particles. From the preceding obſervations likewiſe it appears, that the particles of coloured media inflect the ſeveral ſorts of rays according to the ſeveral ſizes and denſities of the particles; alſo in proportion to the inflammability of the media which owe their colour to them; and it is manifeſt that the tranſmiſſion of coloured rays depends upon their inflection. All theſe obſervations are conformable to Sir Iſaac Newton's doctrine, that the rays of light are reflected, refracted, and inflected, by one and the ſame principle acting variouſly in various circumſtances."

43 Of the manner in which light is reflected from white bodies.

The moſt remarkable part of Mr Delaval's doctrine is that concerning the metals; for the better underſtanding of what we ſhall premiſe a ſhort abſtract of his general doctrine concerning white bodies, and the manner in which light is reflected by them. "All the earths (he obſerves), which in their natural ſtate are of a pure white, conſtitute tranſparent colourleſs media when vitrified with proper fluxes, or when diſſolved in colourleſs menſtrua; and the ſaline maſſes obtainable from their ſolutions are tranſparent and colourleſs while they retain the water which is eſſential to their cryſtallization, and are not flawed or reduced to powder; but after their pores and interſtices are opened in ſuch a manner as to admit the air, they become then white and opaque by the entrance of that rare medium. The earthy particles which form the ſolid parts of bodies generally exceed the others in denſity; conſequently theſe particles, when contiguous to the rare media already mentioned, muſt reflect the rays of light with a force proportionate to their denſity. The reflective power of bodies does not depend merely upon their exceſs of denſity, but upon their difference of denſity, with reſpect to the ſurrounding media. Tranſparent colourleſs particles whoſe denſity is greatly inferior to that of the media they come between, alſo powerfully reflect all ſorts of rays, and thereby become white. Of this kind are the air or other rare fluids which occupy the interſtices of liquors; and in general of all denſer media into whoſe interſtices ſuch rare particles are admitted.

"Hence we may conclude, that white opaque bodies are conſtituted by the union or contiguity of two or more tranſparent colourleſs media differing conſiderably from each other in their reflective powers. Of theſe ſubſtances we have examples in froth, emulſions, or other imperfect combinations of pellucid liquors, milk ſnow, calcined or pulverized ſalts, glaſs or cryſtal reduced to powder, white earths, paper, linen, and even thoſe metals which are called white by mineralogiſts and chemiſts: for the metals juſt mentioned do not appear white unleſs theſe ſurfaces be rough? as in that caſe only there are interſtices on their ſurface ſufficient to admit the air, and thus make a reflection of a white and vivid light.

"But the poliſhed ſurfaces of metallic mirrors reflect the incident rays equably and regularly, according to their ſeveral angles of incidence, ſo that the reflected rays do not interfere with each other, but remain ſeparate and unmixed, and therefore diſtinctly exhibit their ſeveral colours. Hence it is evident, that white ſurfaces cannot act upon the light as mirrors; becauſe all the rays which are reflected from them are blended in a promiſcuous and diſorderly manner.

44 Of the cauſe of opacity.

"The abovementioned phenomena give much inſight into the nature and cauſe of opacity; as they clearly ſhow, that even the rareſt tranſparent colourleſs ſubſtances, when their ſurfaces are adjacent to media differing greatly from them in refractive power, may thereby acquire a perfect opacity, and may aſſume a reſplendency and hue ſo ſimilar to that of white metals, that the rarer pellucid ſubſtances cannot by the ſight be diſtinguiſhed from the denſe opaque metals. And this ſimilarity to the ſurface of metals occurs in the rare pellucid ſubſtances, not only when, from the roughneſs of their ſurfaces, they reſemble unpoliſhed metals in whiteneſs, but alſo when, from their ſmoothneſs, they reſemble the poliſhed ſurfaces of metals.

"Metals ſeem to conſiſt entirely of tranſparent matter, and to derive their apparent opacity and luſtre ſolely from the copious reflection of light from their ſurfaces. The analogy between the metals and tranſparent media, as far as reſpects their optical properties, will appear from the following conſiderations.

"1. All metals diſſolved in their proper menſtrua are tranſparent. 2. By the union of two or more tranſparent media, ſubſtances are conſtituted which are ſimilar to metals in their opacity and luſtre, as plumbago and marcaſites. 3. The tranſparent ſubſtances of metals, as well as thoſe of minerals, by their union with phlogiſton, acquire their ſtrong reflective powers from which their luſtre and opacity ariſe. 4. The ſurfaces of pellucid media, ſuch as glaſs or water, aſſume a metallic appearance, when by their ſmoothneſs, difference of denſity with reſpect to the contiguous media, or any other cauſe, they are diſpoſed copiouſly to reflect the light.

"From all theſe conſiderations it is evident that opaque ſubſtances are conſtituted by the union or contiguity of tranſparent colourleſs media, differing from one another in their reflective powers: and that, when the common ſurface, which comes between ſuch media, is plane, equal, and ſmooth, it reflects the incident rays equally and regularly as a mirror; but when the ſurface is rough and unequal, or divided into minute particles, it reflects the incident rays irregularly and promiſcuouſly in different directions, and conſequently appears white."

45 Theory of colours ſtill uncertain.

From all thoſe experiments we can only conclude, that the theory of colours ſeems not yet to be determined with certainty; and very formidable, perhaps unanſwerable, objections, might be brought againſt every hypotheſis on this ſubject that hath been invented. The diſcoveries of Sir Iſaac Newton, however, are ſufficient to juſtify the following

APHORISMS.

1. All the colours in nature proceed from the rays of light.
2. There are ſeven primary colours: which are red, orange, yellow, green, blue, indigo, and violet.
3. Every ray of light may be ſeparated into the ſeven primary colours.
4. The rays of light in paſſing through the ſame medium have different degrees of refrangibility.
5. The difference in the colours of light ariſes from its different refrangibility: that which is the leaſt refrangible producing red; and that which is the moſt refrangible violet.
6. By compounding any two of the primary colours, as red and yellow, or yellow and blue, the intermediate colour, as orange or green, may be produced.
7. The colours of bodies ariſe from their diſpoſitions to reflect one ſort of rays, and to abſorb the other: thoſe that reflect the leaſt refrangible rays appearing red; and thoſe that reflect the moſt refrangible violet.
8. Such bodies as reflect two or more ſorts of rays appear of various colours.
9. The whiteneſs of bodies ariſes from their diſpoſition to reflect all the rays of light promiſcuouſly.
10. The blackneſs of bodies proceeds from their incapacity to reflect any of the rays of light (c).

Entertaining EXPERIMENTS, *founded on the preceding Principles.*

I. *Out of a ſingle colourleſs ray of light to produce ſeven other rays, which ſhall paint, on a white body, the ſeven primary colours of nature.*

Plate. CXXXV. fig. 1

PROCURE of an optician a large glaſs priſm DEF, well poliſhed, two of whoſe ſides muſt contain an angle of about ſixty-four degrees. Make a room quite dark, and in the window ſhutter AB, cut a round hole, about one-third of an inch in diameter, at C, through which a ray of light LI paſſing, falls on the priſm DEF: by that it is refracted out of the direction IT, in which it would have proceeded into another GH; and, falling on the paper MNSX, will there form an oblong ſpectrum PQ, whoſe ends will be ſemicircular, and its ſides ſtraight; and if the diſtance of the priſm from the paper be about eighteen feet, it will be ten inches long, and two inches wide. This ſpectrum will exhibit all the primary colours: the rays between P and V, which are the moſt refracted, will paint a deep violet: thoſe between V and I, indigo; thoſe between I and B, blue; thoſe between B and G, green; thoſe between G and Y, yellow; thoſe between Y and O, orange; and thoſe between O and R, being the leaſt refracted, an intenſe red. The colours between theſe ſpaces will not be every where equally intenſe, but will incline to the neighbouring colour: thus the part of the orange next to R, will incline to a red; that next to Y, to a yellow: and ſo of the reſt.

II. *From two or more of the primary colours, to compoſe others that ſhall, in appearance, reſemble thoſe of the former.*

BY mixing the two homogeneal colours red and yellow, an orange will be produced ſimilar in appearance to that in the ſeries of primary colours; but the light of the one being homogeneal, and that of the other heterogeneal, if the former be viewed through a priſm it will remain unaltered, but the other will be reſolved into its component colours red and yellow. In like manner other contiguous homogeneal colours may compound new colours; as by mixing yellow and green, a colour between them is formed; and if blue be added, there will appear a green that is the middle colour of thoſe three. For the yellow and blue, if they are equal in quantity, will draw the intermediate green equally toward them, and keep it, at it were, in equilibrio, that it verge not more to the one than to the other. To this compound green there may be added ſome red and violet; and yet the green will not immediately ceaſe, but grow leſs vivid; till by adding more red and violet it will become more diluted; and at laſt by the prevalence of the added colours, it will be overcome, and turned into ſome anomalous colour.

If the ſun's white, compoſed of all kinds of rays, be added

(c) From hence it ariſes, that black bodies, when expoſed to the ſun, become ſooner heated than all others.

Fig. 3

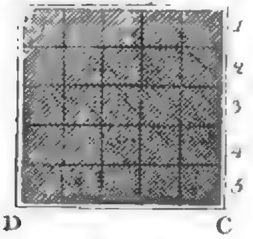


Fig. 2

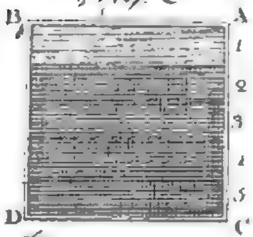


Fig. 1

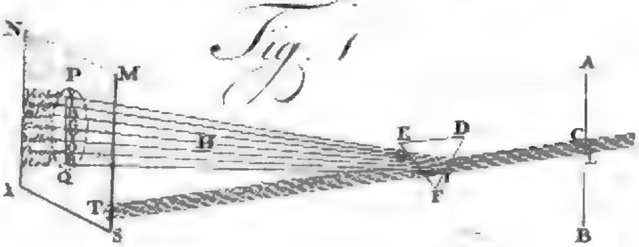


Fig. 7

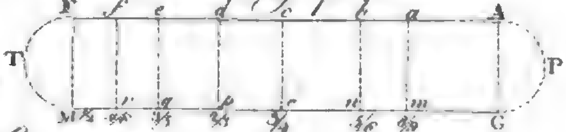


Fig. 4

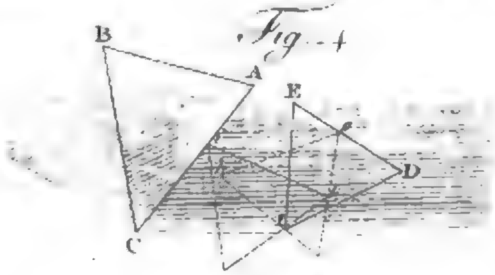


Fig. 9

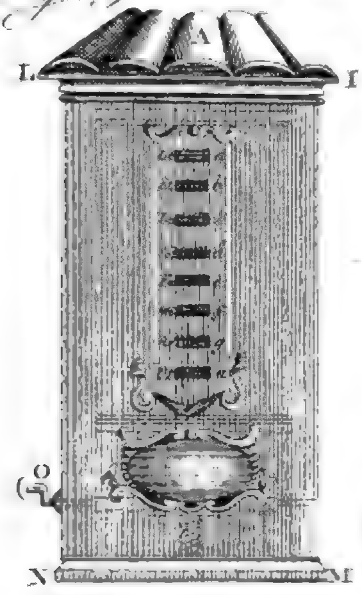


Fig. 8

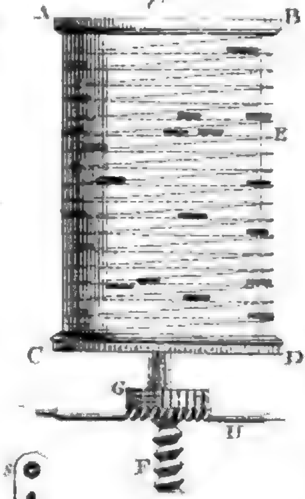
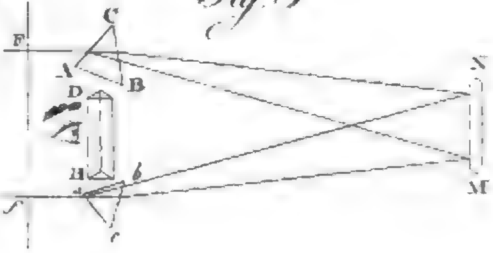
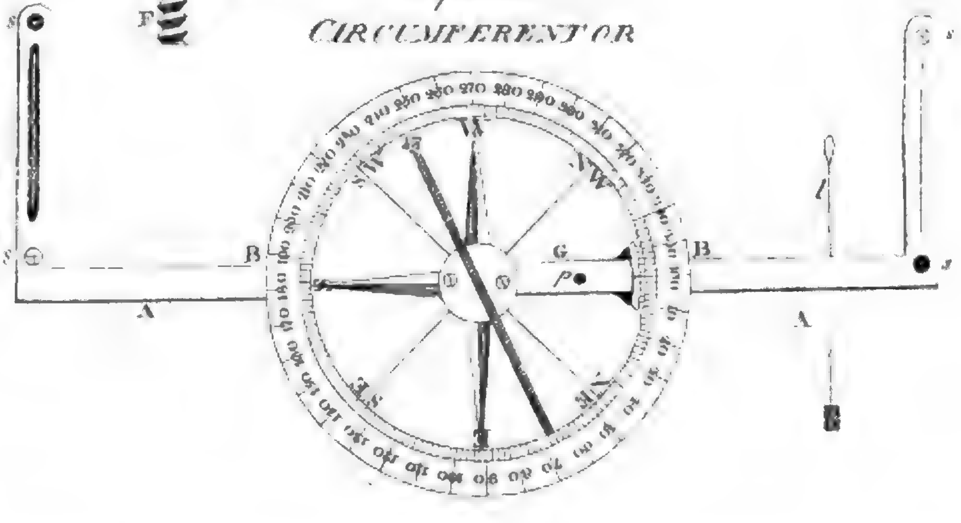


Fig. 6

Fig. 5



Improved.
CIRCUMFERENTOR



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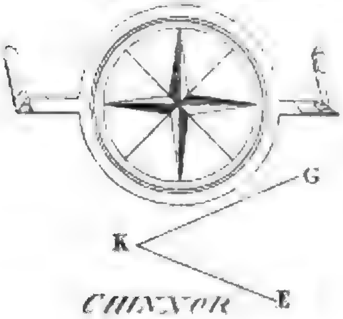

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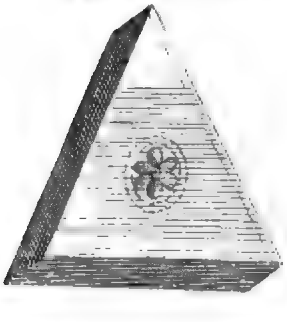
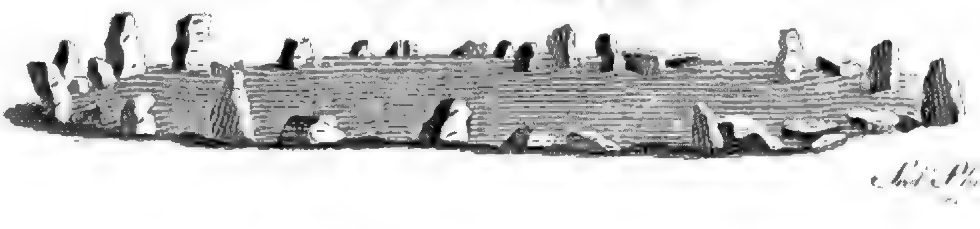


Druidical CIRCLE



Scot Philada

added to any homogeneal colour, that colour will not vaniſh, nor change its ſpecies, but be diluted; and by adding more white, it will become continually more diluted. Laſtly, if red and violet be mixed, there will be generated, according to their various proportions, various purples, ſuch as are not like, in appearance, to the colour of any homogeneal light; and of theſe purples, mixed with blue and yellow, other new colours may be compoſed.

III. *Out of three of the primary colours, red, yellow, and blue, to produce all the other priſmatic colours, and all that are intermediate to them.*

Fig. 2. Provide three panes of glaſs of about five inches ſquare; and divide each of them, by parallel lines, into five equal parts. Take three ſheets of very thin paper; which you muſt paint, lightly, one blue, another yellow, and the third red (D). Then paſte on one of the glaſſes five pieces of the red paper; one of which muſt cover the whole glaſs, the ſecond only the four lower diviſions, the third the three lower, the fourth the two loweſt, and the fifth the laſt diviſion only. On the other two glaſſes five pieces of the blue and yellow papers muſt be paſted in like manner. You muſt alſo have a box of about ſix inches long, and the ſame depth and width as the glaſſes; it muſt be black on the inſide: let one end be quite open, and in the oppoſite end there muſt be a hole large enough to ſee the glaſſes completely. It muſt alſo open at the top, that the glaſſes may be placed in it conveniently.

When you have put any one of theſe glaſſes in the box, and the open end is turned toward the ſun, you will ſee five diſtinct ſhades of the colour it contains. If you place the blue and yellow glaſſes together, in a ſimilar direction, you will ſee five ſhades of green diſtinctly formed. When the blue and red glaſſes are placed, a bright violet will be produced; and by the red and yellow, the ſeveral ſhades of orange.

Fig. 3. If, inſtead of placing theſe glaſſes in a ſimilar poſition, you place the ſide AB of the yellow glaſs againſt the ſide BD of the blue, you will ſee all the various greens that are produced by nature (E); if the blue and red glaſſes be placed in that manner, you will have all the poſſible varieties of purples, violets, &c.; and, laſtly, if the red and orange glaſſes be ſo placed, there will be all the intermediate colours, as the marygold, aurora, &c.

IV. *By means of the three primary colours, red, yellow, and blue, together with light and ſhade, to produce all the gradations of the priſmatic colours.*

On ſeven ſquare panes of glaſs, paſte papers that are painted with the ſeven priſmatic colours, in the ſame manner as in the laſt experiment. The colours for the orange, green, indigo, and violet, may be made by mixing the other three. Then with biſtre (F), well diluted, ſhade a ſheet of very thin paper, by laying it light on both its ſides. With pieces of this paper cover four-fifths of a glaſs, of the ſame ſize with the others, by laying one piece on the four loweſt diviſions, another on the three loweſt, a third on the two loweſt, and the fourth on the loweſt diviſion only, and leaving the top diviſion quite uncovered. When one of the coloured glaſſes is placed in the box, together with the glaſs of ſhades, ſo that the ſide AB of the one be applied to the ſide BC of the other, as in fig. 3. the ſeveral gradations of colours will appear ſhaded in the ſame manner as a drapery judiciouſly painted with that colour.

It is on this principle that certain French artiſts have proceeded in their endeavours to imitate, by deſigns printed in colours, paintings in oil: which they do by four plates of the ſame ſize, on each of which is engraved the ſame deſign. One of theſe contains all the ſhades that are to be repreſented, and which are painted either black or with a dark grey. One of the three other plates is coloured with blue, another with red, and the third with yellow; each of them being engraved in thoſe parts only which are to repreſent that colour (G); and the engraving is either ſtronger or weaker, in proportion to the tone of colour that is to be repreſented (H).

Theſe four plates are then paſſed alternately under the preſs, and the mixture of their colours produces a print that bears no ſmall reſemblance to a painting. It muſt be confeſſed, however, that what has been hitherto done of this kind falls far ſhort of that degree of perfection of which this art appears ſuſceptible. If they who engrave the beſt in the manner of the crayon were to apply themſelves to this art, there is reaſon to expect

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(D) Water-colours muſt be uſed for this purpoſe: the blue may be that of Pruſſia, and very bright; the red, carmine; and the yellow, gambooge, mixed with a little ſaffron. Theſe colours muſt be laid very light and even, on both ſides of the paper.

(E) In the firſt poſition of the glaſſes, the quantity of blue and yellow being equal, the ſame ſort of green was conſtantly viſible: but by thus inverting the glaſſes, the quantity of the colours being conſtantly unequal, a very pleaſing variety of tints is produced.

(F) The biſtre here uſed muſt be made of ſoot, not that in ſtone.

(G) When a red drapery is required, it is engraved on the plate aſſigned to that colour; and ſo of yellow and blue: but if one of the other colours be wanting, ſuppoſe violet, it muſt be engraved on thoſe that print the red and blue: and ſo of the reſt. The plates of this kind have been hitherto engraved in the manner of mezzotinto; but theſe, unleſs they are ſkilfully managed, ſoon become ſmutty. Engravings in the manner of the crayon will perhaps anſwer better.

(H) The principal difficulty in this ſort of engraving ariſes from a want of a ſkilful management, in giving each plate that preciſe degree of engraving which will produce the tone of colour required. If a bright green is to be repreſented, there ſhould be an equal quantity of graving on the red and yellow plates: but if an olive green, the yellow plate ſhould be engraved much deeper than the red.

expect they would produce far more finiſhed pieces than we have hitherto ſeen.

V. *To make figures appear of different colours ſucceſſively.*

Fig. 4. MAKE a hole in the window-ſhutter of a dark room, through which a broad beam of light may paſs, that is to be refracted by the large glaſs priſm ABC, which may be made of pieces of mirrors cemented together, and filled with water. Provide another priſm DEF, made of three pieces of wood; through the middle of this there muſt paſs an axis on which it is to revolve. This priſm muſt be covered with white paper; and each of its ſides cut through in ſeveral places, ſo as to repreſent different figures, and thoſe of each ſide ſhould likewiſe be different. The inſide of this priſm is to be hollow, and made quite black, that it may not reflect any of the light that paſſes through the ſides into it. When this priſm is placed near to that of glaſs, as in the figure, with one of its ſides EF perpendicular to the ray of light, the figures on that ſide will appear perfectly white: but when it comes into the poſition *g h*, the figures will appear yellow and red; and when it is in the poſition *k l*, they will appear blue and violet. As the priſm is turned round its axis, the other ſides will have a ſimilar appearance. If inſtead of a priſm, a four or five ſided figure be here uſed, the appearances will be ſtill further diverſified.

This phenomenon ariſes from the different refrangibility of the rays of light. For when the ſide EF is in the poſition *g h*, it is more ſtrongly illuminated by the leaſt refrangible rays; and wherever they are predominant, the object will appear red or yellow. But when it is on the poſition *k l*, the more refrangible rays being then predominant, it will appear tinged with blue and violet.

VI. *The ſolar magic lantern.*

PROCURE a box, of about a foot high, and eighteen inches wide, or ſuch other ſimilar dimenſions as you ſhall think fit; and about three inches deep. Two of the oppoſite ſides of this box muſt be quite open; and in each of the other ſides let there be a groove, wide enough to paſs a ſtiff paper or paſteboard. This box muſt be faſtened againſt a window on which the ſun's rays fall direct. The reſt of the window ſhould be cloſed up, that no light may enter. Provide ſeveral ſheets of ſtiff paper, which muſt be blacked on one ſide. On theſe papers cut out ſuch figures as you ſhall think proper: and placing them alternately in the grooves of the box, with their blacked ſides towards you, look at them through a large and clear glaſs priſm; and if the light be ſtrong, they will appear to be painted with the moſt lively colours in nature. If you cut on one of theſe papers the form of the rainbow, about three quarters of an inch wide, you will have a lively repreſentation of that in the atmoſphere.

This experiment may be further diverſified, by paſting very thin papers, lightly painted with different colours, over ſome of the parts that are cut out: which will appear to change their colours when viewed through the priſm, and to ſtand out from the paper, at different diſtances, according to the different degrees of refrangibility of the colours with which they are painted. For greater convenience, the priſm may be placed in a ſtand on a table, at the height of your eye, and made to turn round on an axis, that when you have got an agreeable proſpect, you may fix it in that poſition.

VII. *The priſmatic camera obſcura.*

Fig. 5. MAKE two holes F, *f*, in the ſhutter of a dark chamber, near to each other; and againſt each hole place a priſm ABC, and *a b c*, in a perpendicular direction, that their ſpectrums NM may be caſt on the paper in a horizontal line, and coincide with each other; the red and violet of the one being in the ſame part with thoſe of the other. The paper ſhould be placed at ſuch a diſtance from the priſms that the ſpectrum may be ſufficiently dilated. Provide ſeveral papers nearly of the ſame dimenſions with the ſpectrum, croſs theſe papers, and draw lines parallel to the diviſions of the colours. In theſe diviſions cut out ſuch figures as you ſhall find will have an agreeable effect, as flowers, trees, animals, &c. When you have placed one of theſe papers in its proper poſition, hang a black cloth or paper behind it, that none of the rays that paſs through may be reflected and confuſe the phenomenon. The figures cut on the paper will then appear ſtrongly illuminated with all the original colours of nature. If while one of the priſms remains at reſt, the other be revolved on its axis, the continual alteration of the colours will afford a pleaſing variety; which may be further increaſed by turning the priſm round in different directions.

When the priſms are ſo placed that the two ſpectrums become coincident in an inverted order of their colours, the red end of one falling on the violet end of the other; if they be then viewed through a third priſm DH, held parallel to their length, they will no longer appear coincident, but in the form of two diſtinct ſpectrums, *pt* and *nm* (fig. 6.), croſſing one another in the middle, like the letter X: the red of one ſpectrum and the violet of the other, which were coincident at NM, being parted from each other by a greater refraction of the violet to *p* and *m*, than that of the red to *n* and *t*.

This experiment may be further diverſified by adding two other priſms, that ſhall form a ſpectrum in the ſame line, and contiguous in the other; by which not only the variety of figures, but the viciſſitude of colours, will be conſiderably augmented.

The diatonic ſcale of colours.

THE illuſtrious Newton, in the courſe of his inveſtigations of the properties of light, diſcovered that the length of the ſpaces which the ſeven primary colours poſſeſs in the ſpectrum, exactly correſponds to thoſe of chords that ſound the ſeven notes in the diatonic ſcale of muſic. As is evident by the following experiment.

Fig. 7. On a paper in a dark chamber, let a ray of light be largely refracted into the ſpectrum AFTMGP, and mark the preciſe boundaries of the ſeveral colours, as *a*, *b*, *c*, *&c.* Draw lines from thoſe points perpendicular to the oppoſite ſide, and you will find that the ſpaces M *r f* F, by which the red is bounded: *r g e f*, by which the orange is bounded; *q p e d*, by which the yellow is bounded, *&c.* will be in exact proportion

to the diviſions of a muſical chord for the notes of an octave; that is, as the intervals of theſe numbers 1, $\frac{8}{9}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{8}{15}$, $\frac{1}{2}$.

IX. *Colorific muſic.*

Father Castel, a Frenchman, in a curius book he has publiſhed on chromatics, ſuppoſes the note *ut* to anſwer to blue in the priſmatic colours; the note *re* to yellow, and *mi* to red. The other tones he refers to the intermediate colours; from whence he conſtructs the following gamut of colorific muſic:

Ut	Blue
Ut ſharp	Sea-green
Re	Bright green
Re ſharp	Olive green
Mi	Yellow
Fa	Aurora
Fa ſharp	Orange
Sol	Red
Sol ſharp	Crimſon
La	Violet
La ſharp	Blue Violet
Si	Sky blue
Ut	Blue

This gamut, according to his plan, is to be continued in the ſame manner for the following octave; except that the colours are to be more vivid.

He ſuppoſes that theſe colours, by ſtriking the eye in the ſame ſucceſſion as the ſounds (to which he makes them analogous) do the ear, and in the ſame order of time, they will produce a correſpondent ſenſation of pleaſure in the mind. It is on theſe general principles, which F. Caſtel has dilucidated in his treatiſe, that he has endeavoured, though with little ſucceſs, to eſtabliſh his ocular harpſichord.

The conſtruction of this inſtrument, as here explained, will ſhow that the effects produced by colours by no means anſwer thoſe of ſounds, and that the principal relation there is between them conſiſts in the duration of the time that they reſpectively affect the eyes.

Fig. 8. Between two circles of paſteboard, of ten inches diameter, AB and CD, incloſe a hollow paſteboard cylinder E, 18 inches long. Divide this cylinder into ſpaces half an inch wide, by a ſpiral line that runs round it from top to bottom, and divide its ſurface into ſix equal parts by parallel lines drawn between its two extremities; as is expreſſed in the figure.

Let the circle AB, at top, be open; and let that at bottom, CD, be cloſed, and ſupported by an axis or ſcrew, of half an inch diameter, which muſt turn freely in a nut placed at the bottom of a box we ſhall preſently deſcribe. To the axis juſt mentioned adjuſt a wooden wheel G, of two inches and a half in diameter, and that has 12 or 15 teeth, which take the endleſs ſcrew H. Let this cylinder be incloſed in a box ILMN (fig. 9.) whoſe baſe is ſquare, and at whoſe bottom there is a nut in which the axis F turns. Obſerve that the endleſs ſcrew H ſhould come out of the box, that it may receive the handle O, by which the cylinder is to be turned.

This box being cloſed all round, place over it a tin covering A, which muſt be perforated in different parts; from this cover there muſt hang three or four lights, ſo placed that they may ſtrongly illumine the inſide of the cylinder. In one ſide of this box (which ſhould be covered with paſteboard) cut eight apertures, *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, of half an inch wide, and $\frac{1}{4}$ of an inch high; they muſt be directly over each other, and the diſtance between them muſt be exactly two inches. It is by theſe openings, which here correſpond to the muſical notes, that the various colours analogous to them are to appear; and which being placed on the paſteboard cylinder, as we have ſhown, are reflected by means of the lights placed within it. Fig. 9.

It is eaſy to conceive, that when the handle O is turned, the cylinder in conſequence riſing half an inch, if it be turned five times round, it will ſucceſſively ſhow, at the openings made in the ſide of the box, all thoſe that are in the cylinder itſelf, and which are ranged according to the direction of the inclined lines drawn on it. It is therefore according to the duration of the notes which are to be expreſſed, that the apertures on the cylinder are to be cut. Obſerve, that the ſpace between two of the parallel lines drawn vertically on the cylinder, is equal to one meaſure of time; therefore, for every turn of the cylinder, there are ſix meaſures, and thirty meaſures for the air that is to be played by this inſtrument.

The ſeveral apertures being made in the ſide of the cylinder, in conformity to the notes of the tune that is to be expreſſed, they are to be covered with double pieces of very thin paper, painted on both ſides with the colours that are to repreſent the muſical notes.

This experiment might be executed in a different manner, and with a much greater extent; but as the entertainment would not equal the trouble and expence, we have thought it ſufficient to give the above piece, by which the reader will be enabled to judge how far the analogy ſuppoſed by F. Caſtel really exiſts.

Chronic, Chronicle. **CHRONIC**, or Chronical, among phyſicians, an appellation given to diſeaſes that continue a long time; in contradiſtinction to thoſe that ſoon terminate and are called *acute*.

CHRONICLE, in matters of literature, a ſpecies or kind of hiſtory diſpoſed according to the order of time, and agreeing in moſt reſpects with annals. See Annals.

Parian Chronicle. See *Arundelian Marbles*. Since that article was printed, in which an abſtract was given of Mr Robertſon's doubts and obſervations reſpecting the authenticity of the Parian Chronicle, one or two publications have ſince appeared in anſwer, but none of them calculated to remove the objections or materially to affect the arguments that had been ſtated with ſo much learning and ingenuity againſt it. The following ſtrictures, however, with which the Monthly Reviewers have concluded their critique of Mr Robertſon's performance, ſeem to merit conſideration. Chronicle.

On

Monthly Review, Jan. 1789.

On Objection I. *That the characters have no certain or unequivocal marks of antiquity*, the Reviewers remark, that this ſeems rather to be an anſwer to a defender of the inſcription, than an objection. If a zealous partizan of the marble ſhould appeal to its characters and orthography, as deciſive proofs of its being genuine, it would be proper enough to anſwer, that theſe circumſtances afford no certain criterion of authenticity. But in this word *certain* ſculks an unlucky ambiguity. If it means demonſtrative, it muſt be allowed that no inſcription can be proved to be certainly genuine from theſe appearances; but if it means no more than highly probable, many inſcriptions poſſeſs ſufficient internal evidence to give their claims this degree of certainty. The true queſtion is, Has not the Parian Chronicle every mark of antiquity that can be expected in a monument claiming the age of 2000 years? The letters Γ and Ξ are, by Mr R's own confeſſion, ſuch as occur in genuine inſcriptions; and to ſay in anſwer, that an impoſtor might copy the forms of theſe letters from other inſcriptions, is already to ſuppoſe the inſcription forged, before it is rendered probable by argument. The learned author of the Diſſertation ſeems to betray ſome doubt of his own concluſion; for he adds, p. 56. "that the antiquity of an inſcription can never be proved by the mere form of the letters, becauſe the moſt ancient characters are as eaſily counterfeited as the modern." But this objection is equally applicable to all other ancient inſcriptions; and is not to the purpoſe, if the preſent inſcription has any peculiar marks of impoſture in its characters and orthography. "The characters do not reſemble the Sigean, the Nemean, or the Delian inſcriptions." Mr R. anſwers this objection himſelf, by adding, "which are ſuppoſed to be of a more ancient date." The oppoſite reaſon to this will be a ſufficient anſwer to the other objection, "that they do not reſemble the Farneſian pillars or the Alexandrian MS." If "they differ in many reſpects from the Marmor Sandvicenſe," they may be preſumed to agree in many. "They ſeem to reſemble, more than any other, the alphabet taken by Montfaucon from the Marmor Cyzicenum." Thus it appears that the Parian Chronicle moſt nearly reſembles the two inſcriptions, to whoſe age it moſt nearly approaches.

When Mr R. adds, that the letters "are ſuch as an ordinary ſtone-cutter would probably make, if he were employed to engrave a Greek inſcription, according to the alphabet now in uſe," he muſt be underſtood *cum grano ſalis*. The engraver of a fac ſimile generally omits ſome nice and minute touches in taking his copy; but, even with this abatement, we dare appeal to any adept in Greek calligraphy, whether the ſpecimen facing p. 56, will juſtify our author's obſervation? "The ſmall letters (ο, θ, ω) intermixed among the larger, have an air of affectation and artifice." Then has the greater part of ancient inſcriptions an air of affectation and artifice. For the ο is perpetually engraved in this diminutive ſize; and ω being of a kindred ſound, and θ of a kindred ſhape, how can we wonder that all three ſhould be repreſented of the ſame magnitude? In the inſcription which immediately follows the marble in Dr Chandler's edition, N° XXIV. theſe very three letters are never ſo large as the reſt, and often much ſmaller; of which there are inſtances in the three firſt lines. See alſo two medals in the ſecond part of Dorville's Sicula, Tab. XVI. Numb. 7, 9.

"From the archaiſms, ſuch as εγ Λυκωρειαι, εγ Κυβελοις, εμ Παρωι, &c. &c. no concluſion can be drawn in favour of the authenticity of the inſcription." Yet ſurely every thing common to it with other inſcriptions, confeſſedly genuine, creates a reaſonable preſumption in its favour. "But what reaſon could there be for theſe archaiſms in the Parian Chronicle? We do not uſually find them in Greek writers of the ſame age, or even of a more early date." The reaſon is, according to our opinion, that ſuch archaiſms were then in uſe: this we know from other inſcriptions, in which ſuch archaiſms (or, as our author afterward calls them, barbariſms) are frequent. Nothing can be inferred from the Greek writers, unleſs we had their autographs. The preſent ſyſtem of orthography in our printed Greek books is out of the queſtion. Again, "The inſcription ſometimes adopts and ſometimes neglects theſe archaiſms, as in lines 4, 12, 27, 52, 63, 67." This inconſiſtency either is no valid objection, or if it be valid, will demoliſh not only almoſt every other inſcription, but almoſt every writing whatſoever. For example, in the inſcription juſt quoted, N° XXIV. we find τεΝ βασιλεα, l. 20. and σταΜ τιμητηι, 34. A little farther, N° XXVI. l. 31. we have εΓ Μαγνησιας, 57. 73. 81. εΚ Μαγνησιας, and 106. 108. εΚΓ Μαγνησιας. The Corcyrean inſcription (Montfaucon, Diar. Ital. p. 420) promiſcuouſly uſes εΚδανειζομαι and εΓδανειζομαι. In Engliſh, who is ſurpriſed to find *has* and *hath*, *a hand* and *an hand*, *a uſeful* and *an uſeful*, in the works of the ſame author? We could produce inſtances of this inaccuracy from the ſame page, nay from the ſame ſentence.

"The authenticity of thoſe inſcriptions, in which theſe archaiſms appear, muſt be eſtabliſhed, before they can be produced in oppoſition to the preſent argument." This is, we cannot help thinking, rather too ſevere a reſtriction. If no inſcription may be quoted before it be proved genuine, the learned author of the Diſſertation need not be afraid of being confuted; for nobody will engage with him on ſuch conditions. Perhaps the reverſe of the rule will be thought more equitable; that every inſcription be allowed to be genuine, till its authenticity be rendered doubtful by probable arguments. We will conclude this head with two ſhort obſervations. In Selden's copy, l. 26. was written ΠΟΗΣΙΝ, which the later editors have altered to ΠΟΙΗΣΙΝ, but without reaſon, the other being the more ancient way of writing, common in MSS. and ſometimes found on inſcriptions. (See G. Koen's Notes on *Gregorius de Dialectis*, p. 30.) In l. 83. the marble has Καλλιον, for which Palmer wiſhed to ſubſtitute Καλλιου. Dr Taylor refutes him from the *Marmor Sandvicenſe*, obſerving at the ſame time, that this orthography occurs in no other place whatever except in theſe two monuments. Is it likely that two engravers ſhould by chance coincide in the ſame miſtake, or that the forger of the Parian Chronicle (if it be forged) ſhould have ſeen the *Marmor Sandvicenſe*, and taken notice of this peculiarity with the intention of afterward employing it in the fabrication of an impoſture?

The Reviewers next proceed to conſider, but more briefly, the other objections.

II. *It is not probable that the Chronicle was engraved for private uſe.* 1. *Becauſe it was ſuch an expence, as few learned Greeks were able to afford.* If only a *few* were able to afford it, ſome one of thoſe *few* might be willing to incur it. But let Mr R. conſider how likely it is that a modern, and probably a needy Greek, ſhould be more able to afford it in the laſt century, than a learned Greek 2000 years ago! 2. *A manuſcript is more readily circulated.* Do men never prefer cumbrous ſplendor to cheapneſs and convenience? And if this compoſition, inſtead of being engraved on marble, had been committed to parchment, would it have had a better chance of coming down to the preſent age? Such a flying ſheet would ſoon be loſt; or, if a copy had, by miracle, been preſerved to us, the objections to its being genuine would be more plauſible than any that have been urged againſt the inſcription. What Mr R. ſays about the errors to which an inſcription is liable, &c. will only prove that chronological inſcriptions ought not to be engraved; but not that they never were. We allow that the *common* method of writing in the reign of Ptolemy Philadelphus was NOT on STONES. But it was common enough to occur to the mind of any perſon who wiſhed to leave behind him a memorial at once of his learning and magnificence.

III. This objection, *that the marble does not appear to be engraved by public authority*, we ſhall readily admit, though Bentley (Diſſ. on Phalaris, p. 251.) leans to the contrary opinion. In explaining this objection, the learned diſſertator obſerves, that though the expreſſion, αρχοντος εμ Παρωι, would lead us to ſuppoſe that the inſcription related to Paros, not a ſingle circumſtance in the hiſtory of that iſland is mentioned. But this expreſſion only ſhows that the author was an inhabitant of Paros, and intended to give his readers a clue, or *parapegma*, by the aid of which they might adjuſt the general chronology of Greece to the dates of their own hiſtory. "It is as abſurd as would be a marble in Jamaica containing the revolutions of England." We ſee no abſurdity in ſuppoſing a book to be written in Jamaica containing the revolutions of England. The natives of Paros were not unintereſted in events relating to the general hiſtory of Greece, particularly of Athens; and how can we tell whither the author were an *inquilinus* or a native of the iſland; whether he thought it a place beneath his care; or whether he had devoted a ſeparate inſcription to the chronology of Paros?

IV. *It has been frequently obſerved, that the earlier periods of the Grecian hiſtory are involved in darkneſs and confuſion.* Granted. It follows then, that "an author who ſhould attempt to ſettle the dates of the earlier periods would frequently contradict preceding, and be contradicted by ſubſequent, writers: that he would naturally fall into miſtakes: and at beſt could only hope to adopt the moſt probable ſyſtem. But the difficulty of the taſk, or the impoſſibility of ſucceſs, are not ſufficient to prove that no man has been raſh or mad enough to make the attempt." On the contrary, we know that many have made it. What a number of diſcordant opinions has Mr R. himſelf given us from the ancients concerning the age of Homer? This conſideration will in part obviate another objection, that the Parian Chronicle does not agree with any ancient author. For if the ancients contradict one another, how could it follow more than one of them? and why might not the author, without any imputation of ignorance or raſhneſs, ſometimes depart from them all? If indeed he diſagrees with them when they are unanimous, it might furniſh matter for ſuſpicion; though even this would be far from a deciſive argument, unleſs the ancients were ſo extremely unlike the moderns, as never to be fond of ſingular and paradoxical poſitions.

V. *This Chronicle is not once mentioned by any writer of antiquity.* How many of thoſe inſcriptions, which are preſerved to the preſent day, are mentioned by claſſical authors? Verrius Flaccus compoſed a Roman kalendar, which, as a monument of his learning and induſtry, was engraved on marble, and fixed in the moſt public part of Preneſte. Fragments of this very kalendar were lately dug up at Preneſte, and have been publiſhed by a learned Italian. Now, if the paſſage of Suetonius, which informs us of this circumſtance, had been loſt, would the ſilence of the Latin writers prove that the fragments were not genuine remains of antiquity? It may be ſaid that the caſes are not parallel; for not a ſingle author mentions the Parian Chronicle, whereas Suetonius does mention Verrius's Roman kalendar. To this we anſwer, It is dangerous to deny the authenticity of any monument on the ſlender probability of its being caſually mentioned by a ſingle author. We ſhall alſo obſerve, that this fact of the Hemicyclium of Verrius will anſwer ſome part of the Diſſertator's ſecond objection: "The Parian Chronicle is not an inſcription that might have been concealed in a private library." Why not? it is of no extraordinary bulk; and might formerly have been concealed in a private library, or in a private room, with as much eaſe as many inſcriptions are now concealed in very narrow ſpace. But unleſs the monument were placed in ſome conſpicuous part of the iſland, and obtruded itſelf on the notice of every traveller, the wonder will in great meaſure ceaſe why it is never quoted by the ancients. Of the nine authors named in p. 109, had any one ever viſited Paros? If Pauſanias had travelled thither, and publiſhed his deſcription of the place, we might perhaps expect to find ſome mention of this marble in ſo curious and inquiſitive a writer. But though the inſcription exiſted, and were famous at Paros, there ſeems no neceſſity for any of the authors whoſe works are ſtill extant to have known or recorded it. If there be, let this learned antagoniſt point out the place where this mention ought to have been made. If any perſons were bound by a ſtronger obligation than others to ſpeak of the Parian inſcription, they muſt be the profeſſed chronologers; but alas! we have not the entire works of ſo much as a ſingle ancient chronologer: It is therefore impoſſible to determine whether this Chronicle were quoted by any ancient. And ſuppoſing it had been ſeen by ſome ancient, whoſe writings ſtill remain, why ſhould he make particular mention of it? Many authors, as we know from their remains, very freely copied their predeceſſors without naming them. Others, finding only a collection of bare events in the inſcription, without hiſtorical proofs or reaſons, might entirely neglect it, as deſerving no credit. Mr R. ſeems to lay much ſtreſs on the preciſe, exact, and particular ſpecification of the events, p. 109. But he ought to reflect, that this abrupt and poſitive method of ſpeaking is not only uſual, but neceſſary, in ſuch ſhort ſyſtems of chronology as the marble contains, where events only, and their dates, are ſet down, unaccompanied by any examination of evidences for and againſt, without ſtating any computation of probabilities, or deduction of reaſons. When therefore a chronological writer had undertaken to reduce the general hiſtory of Greece into a regular and conſiſtent ſyſtem, admitting that he was acquainted with this inſcription, what grounds have we to believe that he would ſay any thing about it? Either his ſyſtem coincided with the Chronicle or not: if it coincided, he would very probably diſdain to prop his own opinions with the unſupported aſſertions of another man, who, as far as he knew was not better informed than himſelf. On the other hand, if he differed from the authority of the marble, he might think it a ſuperfluous exertion of complaiſance, to refute, by formal demonſtration, a writer who had choſen to give no reaſons for his own opinion. We ſhall paſs hence to

Objection VII. With reſpect to the parachroniſms that Mr R. produces, we ſhall without heſitation grant, that the author of the inſcription may have committed ſome miſtakes in the chronology, as perhaps concerning Phidon, whom he ſeems to have confounded with another of the ſame name, &c. But theſe miſtakes will not conclude againſt the antiquity of the inſcription, unleſs we at the ſame time reject many of the principal Greek and Roman writers, who have been convicted of ſimilar errors. We return therefore to

Objection VI. *Some of the facts ſeem to have been taken from authors of a later date.* We have endeavoured impartially to examine and compare the paſſages quoted in proof of this objection; but we are obliged to confeſs, that we do not perceive the fainteſt traces of theft or imitation. One example only deſerves to be excepted; to which we ſhall therefore pay particular attention.

"The names of ſix; and, if the lacunæ are properly ſupplied, the names of twelve cities, appear to have been engraved on the marble, exactly as we find them in Ælian's Various Hiſtory. But there is not any imaginable reaſon for this particular arrangement. It does not correſpond with the time of their foundation, with their ſituation in Ionia, with their relative importance, or with the order in which they are placed by other eminent hiſtorians."

The chance of ſix names, ſays Mr R. being placed by two authors in the ſame order, is as 1 to 720; of 12, as 1 to 479,001,600. "It is therefore utterly improbable that theſe names would have been placed in this order on the marble, if the author of the inſcription had not tranſcribed them from the hiſtorian."

On this argument we ſhall obſerve, 1. That the very contrary concluſion might poſſibly be juſt, that the hiſtorian tranſcribed from the inſcription. Yet we ſhall grant that in the preſent caſe this is improbable, eſpecially if the author of the Various Hiſtory be the ſame Ælian, who, according to Philoſtratus, Vit. Sophiſt. II. 31. never quitted Italy in his life. But an intermediate writer might have copied the marble, and Ælian might have been indebted to him. 2dly, We ſee no reaſon to allow, that the *lacunæ* are properly ſupplied. Suppoſe we ſhould aſſert, that the names ſtood originally thus: Miletus, Epheſus, Erythræ, Clazomenæ, Lebedos, Chios, Phocæa, Colophon, Myus, Priene, Samos, Teos. In this arrangement, only four names would be together in the ſame order with Ælian; and from theſe Miletus muſt be excepted, becauſe there is an obvious reaſon for mentioning that city firſt. Three only will then remain; and ſurely that is too ſlight a reſemblance to be conſtrued into an imitation. For Pauſanias and Paterculus, quoted by our author, p. 154, have both enumerated the ſame twelve cities, and both agree in placing the five laſt in the ſame order; nay, the ſix laſt, if Voſſius's conjecture that TEUM ought to be inſerted in Paterculus after Myum TEM be as true as it is plauſible. But who imagines that Pauſanias had either opportunity or inclination to copy Paterculus? 3dly, Allowing that the names were engraved on the marble exactly in the order that Ælian has choſen, is there no way of ſolving the phenomenon but by ſuppoſing that one borrowed from the other? Seven authors at leaſt (Mr R ſeems to ſay more, p. 154, 5.) mention the colonization of the ſame cities: how many authors now loſt may we reaſonably conjecture to have done the ſame? If therefore the compoſer of the Chronicle and Ælian lighted on the ſame author, the former would probably preſerve the ſame arrangement that he found, becauſe in tranſcribing a liſt of names, he could have no temptation to deviate; and the latter would certainly adhere faithfully to his original, becauſe he is a notorious and ſervile plagiariſt. Mr R. indeed thinks, p. 158, that if a ſucceeding writer had borrowed the words of the inſcription, he would not have ſuppreſſed the name of the author. This opinion muſt fall to the ground, if it be ſhown that Ælian was accuſtomed to ſuppreſs the names of the authors to whom he was obliged. Ælian has given a liſt of fourteen celebrated gluttons; and, elſewhere, another of twenty-eight drunkards (from which, by the way, it appears, that people were apt to eat and drink rather too freely in ancient as well as modern times); and both theſe liſts contain exactly the ſame names in the ſame order with Atheneus. Now, it is obſervable, that fourteen names may be tranſpoſed 87,178,291,200 different ways, and that twenty-eight names admit of 304,888,344,611,713,860,501,504,000,000 different tranſpoſitions, &c. &c. Ælian therefore tranſcribed them from Atheneus? yet Ælian never mentions Atheneus in his Various Hiſtory. So that whether Ælian copied from the marble, or only drew from a common ſource, he might, and very probably would, conceal his authority.

VIII. *The hiſtory of the diſcovery of the Marbles is obſcure and unſatisfactory.*

In p. 169, it is ſaid to be "related with ſuſpicious circumſtances, and without any of thoſe clear and unequivocal evidences which always diſcriminate truth from falſehood." The queſtion then is finally decided. If the inſcription has not any of thoſe evidences which truth always poſſeſſes, and which falſehood always wants, it is moſt certainly forged. The learned diſſertator ſeems for a moment to have forgotten the modeſt character of a *doubter*, and to perſonate the dogmatiſt. But waving this, we ſhall add, that, as far as we can ſee, no appearance of fraud is diſcoverable in any part of the tranſaction. The hiſtory of many inſcriptions is related in a manner equally unſatisfactory; and if it could be clearly proved that the marble was dup up at Paros, what would be eaſier for a critic, who is determined at any rate to object, than to ſay, that it was buried there in order to be afterward dug up? If the perſon who brought this treaſure to light had been charged on the ſpot with forging it, or concurring in the forgery, and had then refuſed to produce the external evidences of its authenticity, we ſhould have a right to queſtion, or perhaps to deny, that it was genuine. But no ſuch objection having been made or hinted, at the original time of its diſcovery, it is unreaſonable to require ſuch teſtimony as it is now impoſſible to obtain. "There is nothing ſaid of it in Sir T. Roe's negotiations." What is the inference? That Sir Thomas knew nothing of it, or believed it to be ſpurious, or forged it, or was privy to the forgery? Surely nothing of this kind can be pretended. But let our author account for the circumſtance if he can. To us it ſeems of no conſequence on either ſide. "Peireſc made no effort to recover this precious relic; and from his compoſure he ſeems to have entertained ſome ſecret ſuſpicions of its authenticity." Peireſc would have had no chance of recovering it after it was in the poſſeſſion of lord Arundel's agents. He was either a real or a pretended patron of letters; and it became him to affect to be pleaſed that the inſcription had come into England, and was illuſtrated by his learned friend Selden. John F. Gronovius had, with great labour and expence, collated Anna Comnena's Alexiades, and intended to publiſh them. While he was waiting for ſome other collations, they were intercepted, and the work was publiſhed by another. As ſoon as Gronovius heard this unpleaſant news, he anſwered, that learned men were engaged in a common cauſe; that if one prevented another in any publication, he ought rather to be thanked for lightening the burden, than blamed for interfering. But who would conclude from this anſwer, that Gronovius thought the Alexiades ſpurious, or not worthy of any regard?

Mr R. calculates, that the venders of the marble received 2 0 pieces. But here again we are left in the dark, unleſs we knew the preciſe value of theſe pieces. Perhaps they might be equal to an hundred of our pounds, perhaps only to fifty. Beſides, as they at firſt bargained with Samſon Peireſc's ſuppoſed Jew agent for fifty pieces only, they could not have forged the inſcription with the clear proſpect of receiving more; neither does it appear that they were paid by Samſon. It is fully as reaſonable to ſuppoſe fraud on the one ſide as on the other; and if Samſon, after having the marble in his poſſeſſion, refuſed or delayed to pay the ſum ſtipulated, he might, in conſequence of ſuch refuſal or delay, be thrown into priſon, and might, in revenge, damage the marble before the owners could recover it. We own this account of ours to be a romance; but it is lawful to combat romance with romance.

IX. *The world has been frequently impoſed upon by ſpurious books and inſcriptions; and therefore we ſhould be extremely cautious with regard to what we receive under the venerable name of antiquity.*

Much truth is obſervable in this remark. But the danger lies in applying ſuch general apophthegms to particular caſes. In the firſt place, it muſt be obſerved, that no forged books will exactly ſuit Mr R.'s purpoſe, but ſuch as pretend to be the author's own hand-writing, nor any inſcriptions, but ſuch as are ſtill extant on the original materials, or ſuch as were known to be extant at the time of their pretended diſcovery. Let the argument be bounded by theſe limits, and the number of forgeries will be very much reduced. We are not in poſſeſſion of Cyriacus Anconitanus's book; but if we were governed by authority, we ſhould think that the teſtimony of Reineſius in his favour greatly overbalances all that Auguſtinus has ſaid to his prejudice. The opinion of Reineſius is of the more weight, becauſe he ſuſpects Urſinus of publiſhing counterfeit monuments. We likewiſe find the moſt eminent critics of the preſent age quoting Cyriacus without ſuſpicion (*Vid.* Ruhnken. in Timæi Lex. Plat. p. 10. apud Koen, ad Gregor. p. 140.) The doctrine advanced in the citation from Hardouin is exactly conformable to that writer's uſual paradoxes. He wanted to deſtroy the credit of all the Greek and Latin writers. But inſcriptions hung like a millſtone about the neck of his project. He therefore reſolved to make ſure work, and to deny the genuineneſs of as many as he ſaw convenient: to effect which purpoſe, he intrenches himſelf in a general accuſation. If the author of the diſſertation had quoted a few more paragraphs from Hardouin, in which he endeavours, after his manner, to ſhow the forgery of ſome inſcriptions, he would at once have adminiſtered the poiſon and the antidote. But to the reveries of that learned madman, reſpecting Greek ſuppoſititious compoſitions of this nature, we ſhall content ourſelves with oppoſing the ſentiments of a modern critic, whoſe judgment on the ſubject of ſpurious inſcriptions will not be diſputed. Maffei, in the introduction to the third book, c. 1. p. 51. of his admirable, though unfiniſhed, work *de Arte Critica Lapidaria*, uſes theſe words: *Inſcriptionum Græce loquentium commentitias, ſi cum Latinis comparemus, deprehendi paucas; neque enim ullum omnino eſt, in tanta debacchantium falſariorum libidine, monumenti genus, in quod ii ſibi minus licere putaverint. Argumenta eſt, pauciſſimas uſque in hanc diem ab eruditis viris, et in hoc literarum genere plurimum verſatis rejectas eſſe, falſique damnatas.*

Books of CHRONICLES, a canonical writing of the Old Teſtament. It is uncertain which were written firſt, *The Books of Kings*, or *The Chronicles*, ſince they each refer to the other. However it be, the latter is often more full and comprehenſive than the former. Whence the Greek interpreters call theſe two books Παραλειπομενα *Supplements*, *Additions*, becauſe they contain ſome circumſtances which are omitted in the other hiſtorical books. The Jews make but one book of the Chronicles, under the title of *Dibre-Haiamim*, i. e. *Journals or Annals*. Ezra is generally believed to be the author of theſe books. It is certain they were written after the end of the Babyloniſh captivity and the firſt year of the reign of Cyrus, of whom mention is made in the laſt chapter of the ſecond book.

The *Chronicles*, or *Paraleipomena*, are an abridgement of all the ſacred hiſtory, from the beginning of the Jewiſh nation to their firſt return from the captivity taken out of thoſe books of the Bible which we ſtill have, and out of other annals which the author had then by him. The deſign of the writer was to give the Jews a ſeries of their hiſtory. The firſt book relates to the riſe and propagation of the people of Iſrael from Adam, and gives a punctual and exact account of the reign of David. The ſecond book ſets down the progreſs and end of the kingdom of Judah, to the very year of their return from the Babyloniſh captivity.

CHRONOGRAM, a ſpecies of falſe wit, conſiſting in this, that a certain date or epocha is expreſſed by numeral letters of one or more verſes; ſuch is that which makes the motto of a medal ſtruck by Guſtavus Adolphus in 1632:

ChrIſtVs DVX; ergo trIVMphVs.

CHRONOLOGY,

TREATS of time, the method of meaſuring its parts, and adapting theſe, when diſtinguiſhed by proper marks and characters, to paſt tranſactions, for the illuſtration of hiſtory.

1 How divided.

This ſcience therefore conſiſts of two parts. The firſt treats of the proper meaſurement of time, and the adjuſtment of its ſeveral diviſions; the ſecond of fixing the dates of the various events recorded in hiſtory, and ranging them, according to the ſeveral diviſions of time, in the order in which they happened.

2 Chronology unknown to the ancients.

Chronology, comparatively ſpeaking, is but of modern date. The ancient poets appear to have been entirely unacquainted with it; and Homer, the moſt celebrated of them all, mentions nothing like a formal kalendar in any part of his writings. In the moſt early periods, the only meaſurement of time was by the ſeaſons, the revolutions of the ſun and moon; and many ages muſt have elapſed before the mode of computation by dating events came into general uſe. Several centuries intervened between the era of the olympic games and the firſt hiſtorians; and ſeveral more between theſe and the firſt authors of chronology.

3 Inaccurate methods of computing time at firſt made uſe of.

When time firſt began to be reckoned, we find its meaſures very indeterminate. The ſucceſſion of Juno's prieſteſſes at Argos ſerved Hellanicus for the regulation of his narrative; while Ephorus reckoned his matters by generations. Even in the hiſtory of Herodotus and Thucydides, we find no regular date for the events recorded; nor was there any attempt to eſtabliſh a fixed era, until the time of Ptolemy Philadelphus, who attempted it by comparing and correcting the dates of the olympiads, the kings of Sparta, and the ſucceſſion of the prieſteſſes of Juno at Argos. Eratoſthenes and Apollodorus digeſted the events recorded by them according to the ſucceſſion of the olympiads and of the Spartan kings.

The uncertainty of the meaſures of time in the moſt early periods renders the hiſtories of thoſe times equally uncertain; and even after the invention of dates and eras, we find the ancient hiſtorians very inattentive to them, and inaccurate in their computations. Frequently their eras and years were reckoned differently without their being ſenſible of it, or at leaſt without giving the reader any information concerning it; a circumſtance which has rendered the fragments of their works now remaining of very little uſe to poſterity. The Chaldean and Egyptian writers are generally acknowledged to be fabulous; and Strabo acquaints us, that Diodorus Siculus, and the other early hiſtorians of Greece, were ill informed and credulous.

4 Ancient hiſtorians not to be credited.

Hence the diſagreement among the ancient hiſtorians, and the extreme confuſion and contradiction we meet with on comparing their works. Hellanicus and Aceſilaus diſagreed about their genealogies; the latter rejected the traditions of Heſiod. Timæus accuſed Ephorus of falſehood, and the reſt of the world accuſed Timæus. The moſt fabulous legends were impoſed on the world by Herodotus; and even Thucydides and Diodorus, generally accounted able hiſtorians, have been convicted of error. The chronology of the Latins is ſtill more uncertain. The records of the Romans were deſtroyed by the Gauls; and Fabius Pictor, the moſt ancient of their hiſtorians, was obliged to borrow the greateſt part of his information from the Greeks. In other European nations the chronology is ſtill more imperfect and of a later date; and even in modern times, a conſiderable degree of confuſion and inaccuracy has ariſen from want of attention in the hiſtorians to aſcertain the dates and epochs with preciſion.

5 Utility of chronology, liſt of chronologers, &c.

From theſe obſervations it is obvious how neceſſary a proper ſyſtem of chronology muſt be for the right underſtanding of hiſtory, and likewiſe how very difficult it muſt be to eſtabliſh ſuch a ſyſtem. In this, however, ſeveral learned men have excelled, particularly Julius Africanus, Euſebius of Cæſarea, George Cyncelle, John of Antioch, Dennis, Petau, Cluviar, Calviſius, Uſher, Simſon Marſham, Blair, and Playfair. It is founded, 1. On aſtronomical obſervations, particularly of the eclipſes of the ſun and moon, combined with the calculations of the eras and years of different nations. 2. The teſtimonies of credible authors. 3. Thoſe epochs in hiſtory which are ſo well atteſted and determined, that they have never been controverted. 4. Ancient medals, coins, monuments, and inſcriptions. None of theſe, however, can be ſufficiently intelligible without an explanation of the firſt part, which, we have already obſerved, conſiders the diviſions of time, and of which therefore we ſhall treat in the firſt place.

6 Of the diviſion of time into days.

The moſt obvious diviſion of time is derived from the apparent revolutions of the celeſtial bodies, particularly of the ſun, which by the viciſſitudes of day and night becomes evident to the moſt barbarous and ignorant nations. In ſtrict propriety of ſpeech the word *day* ſignifies only that portion of time during which the ſun diffuſes light on any part of the earth; but in the moſt comprehenſive ſenſe, it includes the night alſo, and is called by chronologers a *civil* day; by aſtronomers a *natural*, and ſometimes an *artificial*, day.

7 Civil, ſolar, &c. days defined.

By a civil day is meant the interval betwixt the ſun's departure from any given point in the heavens and next return to the ſame, with as much more as anſwers to its diurnal motion eaſtward, which is at the rate of 59 minutes and 8 ſeconds of a degree, or 3 minutes and 57 ſeconds of time. It is alſo called a *ſolar* day, and is longer than a *ſidereal* one, inſomuch that, if the former be divided into 24 equal parts or hours, the latter will conſiſt only of 23 hours 56 minutes. The apparent inequality of the ſun's motion, likewiſe, ariſing from the obliquity of the ecliptic, produces another inequality in the length of the days: and hence the difference betwixt real and apparent time, ſo that the apparent motion of the ſun cannot always be a true meaſure of duration. Thoſe inequalities, however, are capable of being reduced to a general ſtandard, which furniſhes an exact meaſure throughout the year; whence ariſes the difference between mean and apparent time, as is explained under the article ASTRONOMY.

8 Different ways of computing the beginning of the day.

There have been very conſiderable differences among nations with regard to the beginning and ending of their days. The beginning of the day was counted from ſunriſe by the Babylonians, Syrians, Perſians, and Indians. The civil day of the Jews was begun from ſunriſe, and their ſacred one from ſunſet; the latter mode of computation being followed by the Athenians, Arabs, ancient Gauls, and other European nations. According to ſome, the Egyptians bégan their day at ſunſet, while others are of opinion that they computed from noon or from ſunriſe; and Pliny informs us that they computed their civil day from one midnight to another. It is probable, however, that they had different modes of computation in different provinces or cities. The Auſonians, the moſt ancient inhabitants of Italy, computed the day from midnight; and the aſtronomers of Cathay and Oighur in the Eaſt Indies reckoned in the ſame manner. This mode of computation was adopted by Hipparchus, Copernicus, and other aſtronomers, and is now in common uſe among ourſelves. The *aſtronomical* day, however, as it is called, on account of its being uſed in aſtronomical calculations, commences at noon, and ends at the ſame time the following day. The Mahometans reckon from one twilight to another. In Italy, the civil day commences at ſome indeterminate point after ſunſet: whence the time of noon varies with the ſeaſon of the year. At the ſummer ſolſtice, the clock ſtrikes 16 at noon, and 19 at the time of the winter ſolſtice. Thus alſo the length of each day differs by ſeveral minutes from that immediately preceding or following it. This variation requires a conſiderable difficulty in adjuſting their time by clocks. It is accompliſhed, however, by a ſudden movement which corrects the difference when it amounts to a quarter of an hour; and this it does ſometimes at the end of eight days, ſometimes at the end of 15, and ſometimes at the end of 40. Information of all this is given by a printed kalendar, which announces, that from the 16th of February, for inſtance, to the 24th, it will be noon at a quarter paſt 18; from the 24th of February to the 6th of March, it will be noon at 18 o'clock preciſely; from the firſt of June to the 13th of July, the hour of noon will be at 16 o'clock; on the 13th of July it will be at half an hour after 16; and ſo on throughout the different months of the year. This abſurd method of meaſuring the day continues, notwithſtanding ſeveral attempts to ſuppreſs it, throughout the whole of Italy, a few provinces only excepted.

9 Strange method of computation in Italy.

10 Various ſubdiviſions of the day.

The ſubdiviſions of the day have not been leſs various than the computations of the day itſelf. The moſt obvious diviſion, and which could at no time, nor in no age, be miſtaken, was that of morning and evening. In proceſs of time the two intermediate points of noon and midnight were determined; and this diviſion into quarters was in uſe long before the invention of hours.

From this ſubdiviſion probably aroſe the method uſed by the Jews and Romans of dividing the day and night into four vigils or watches. The firſt began at ſun-riſing, or ſix in the morning; the ſecond at nine; the third at twelve; and the fourth at three in the afternoon. In like manner the night was divided into four parts; the firſt beginning at ſix in the evening, the ſecond at nine, the third at twelve, and the fourth at three in the morning. The firſt of theſe diviſions was called by the Jews the *third* hour of the day; the ſecond the *ſixth*; the third the *ninth*; and the fourth the *twelfth*, and ſometimes the *eleventh*. Another diviſion in uſe, not only among the nations abovementioned, but the Greeks alſo, was that which reckoned the firſt quarter from ſunſet to midnight; the ſecond from midnight to ſunriſe; the third, or morning watch, from morning to noon; and the fourth from noon to ſunſet.

11 Inventions of hours uncertain.

It is uncertain at what time the more minute ſubdiviſion of the day into hours firſt commenced. It does not appear from the writings of Moſes that he was acquainted with it, as he mentions only the morning, mid-day, evening, and ſunſet. Hence we may conclude, that the Egyptians at that time knew nothing of it, as Moſes was well ſkilled in their learning. According to Herodotus, the Greeks received the knowledge of the twelve hours of the day from the Babylonians. It is probable, however, that the diviſion was actually known and in uſe before the name *hour* was applied to it; as Cenſorinus informs us that the term was not made uſe of in Rome for 300 years after its foundation; nor was it known at the time the twelve tables were conſtructed.

The eaſtern nations divide the day and night in a very ſingular manner; the origin of which is not eaſily diſcovered. The Chineſe have five watches in the night, which are announced by a certain number of ſtrokes on a bell or drum. They begin by giving one ſtroke, which is anſwered by another; and this is repeated at the diſtance of a minute or two, until the ſecond watch begin, which is announced by two ſtrokes; and ſo on throughout the reſt of the watches. By the ancient Tartars, Indians, and Perſians, the day was divided into eight parts, each of which contained ſeven hours and a half. The Indians on the coaſt of Malabar divide the day into ſix parts, called *najika*; each of theſe ſix parts is ſubdivided into 60 others, called *venaigas*; the venaiga into 60 *birpes*, the birpe into 10 *kerikans*; the kenikan into four *mattires*, the mattire into eight *kannimas* or *caignodes*; which diviſions, according to our mode of computation, ſtand as follows.

12 Method of computation on the coaſt of Malabar.

Najika,

Najika,	Venaiga,	Birpe,	Kenikan,	Mattire,	Caignode.
24 min.	24 ſec.	4 ſec.	$\frac{2}{3}$ ſec.	$\frac{4}{15}$ ſec.	$\frac{2}{15}$ ſec.

The day of the Chineſe is begun at midnight, and ends with the midnight following. It is divided into twelve hours, each diſtinguiſhed by a particular name and figure. They alſo divide the natural day into 100 parts, and each of theſe into 100 minutes; ſo that the whole contains 10,000 minutes. In the northern parts of Europe, where only two ſeaſons are reckoned in the year, the diviſions of the day and night are conſiderably larger than with us. In Iceland the 24 hours are divided into eight parts; the firſt of which commences at three in the morning; the ſecond at five; the third at half an hour after eight; the fourth at eleven; the fifth at three in the afternoon; the ſixth at ſix in the evening; the ſeventh, at eight, and the laſt at midnight. In the eaſtern part of Turkeſtan, the day is divided into twelve equal parts, each of which is diſtinguiſhed by the name of ſome animal. Theſe are ſubdivided into eight *keh*; ſo that the whole 24 hours contain 96 *keh*.

13
Diviſions of the hour into minutes, &c.

The modern diviſions of the hour in uſe among us are into minutes, ſeconds, thirds, fourths, &c. each being a ſixtieth part of the former ſubdiviſion. By the Chaldæans, Jews, and Arabians, the hour is divided into 1080 ſcruples; ſo that one hour contains 60 minutes, and one minute 18 ſcruples. The ancient Perſians and Arabs were likewiſe acquainted with this diviſion; but the Jews are ſo fond of it, that they pretend to have received it in a ſupernatural manner. "Iſſichar (ſay they) aſcended into heaven, and brought from thence 1080 parts for the benefit of the nation."

14
Methods of announcing the hours.

The diviſion of the day being aſcertained, it ſoon became an object to indicate in a public manner the expiration of any particular hour or diviſion; as without ſome general knowledge of this kind, it would be in a great meaſure impoſſible to carry on buſineſs. The methods of announcing this have been likewiſe very different. Among the Egyptians it was cuſtomary for the prieſts to proclaim the hours like watchmen among us. The ſame method was followed at Rome; nor was there any other method of knowing the hours until the year 293 B. C. when Papirius Curſor firſt ſet up a ſun-dial in the Capitol. A ſimilar method is practiſed among the Turks, whoſe prieſts proclaim from the top of their moſques, the cock-crowing, day-break, mid-day, three o'clock in the afternoon, and twilight, being their appointed times of worſhip.

15
Invention of inſtruments for this purpoſe.

As this mode of proclaiming the hour could not but be very inconvenient as well as imperfect, the introduction of an inſtrument which every one could have in his poſſeſſion, and which might anſwer the ſame purpoſe, muſt have been conſidered as a valuable acquiſition. One of the firſt of theſe was the clepſydra or water clock*. Various kinds of theſe were in uſe among the Egyptians at a very early period. The invention of the inſtrument is attributed to Thoth or Mercury, and it was afterwards improved by Cteſibus of Alexandria. It was a common meaſure of time among the Greeks, Indians, and Chaldæans, as well as the Egyptians, but was not introduced into Rome till the time of Scipio Naſica. The Chineſe aſtronomers have long made uſe of it; and by its means divided the zodiac into twelves parts; but it is a very inaccurate meaſure of time, varying, not only according to the quantity of water in the veſſel, but according to the ſtate of the atmoſphere.

* See Clepſydra.

The cleplydra was ſucceeded by the gnomon or ſun-dial.—This, at firſt, was no more than a ſtile erected perpendicularly to the horizon; and it was a long time before the principles of it came to be thoroughly underſtood. The invention is with great probability attributed to the Babylonians, from whom the Jews received it before the time of Ahaz, when we know that a ſun-dial was already erected at Jeruſalem. The Chineſe and Egyptians alſo were acquainted with the uſe of the dial at a very early period, and it was conſiderably improved by Anaximander or Anaximenes; one of whom is for that reaſon looked upon to be the inventor. Various kinds of dials, however, were invented and made uſe of in different nations long before their introduction at Rome. The firſt erected in that city, as has been already mentioned, was that by Papirius Curſor; and 30 years after, Valerius Meſſala brought one from Sicily, which was uſed in Rome for no leſs than 99 years, though conſtructed for a Sicilian latitude, and conſequently incapable of ſhowing the hours exactly in any other place; but at laſt another was conſtructed by L. Philippus, capable of meaſuring time with greater accuracy.

It was long after the invention of dials before mankind began to form any idea of clocks; nor is it well known at what period they were firſt invented. A clock was ſent by Pope Paul I. to Pepin king of France, which at that time was ſuppoſed to be the only one in the world. A very curious one was alſo ſent to Charles the Great from the khalif Haroun Alraſchid, which the hiſtorians of the time ſpeak of with ſurpriſe and admiration: but the greateſt improvement was that of Mr Huygens, who added the pendulum to it. Still, however, the inſtruments for dividing time were found to be inaccurate for nice purpoſes. The expanſion of the materials by heat, and their contraction by cold, would cauſe a very perceptible alteration in the going of an inſtrument in the ſame place at different times of the year, and much more if carried from one climate to another. Various methods have been contrived to correct this; which indeed can be done very effectually at land by a certain conſtruction of the pendulum; but at ſea, where a pendulum cannot be uſed, the inaccuracy is of conſequence much greater: nor was it thought poſſible to correct the errors ariſing from theſe cauſes in any tolerable degree, until the late invention of Mr Harriſon's time-piece, which may be conſidered as making perhaps as near an approach to perfection as poſſible.

16
Of weeks.

Having thus given an account of the more minute diviſions of time, with the methods of meaſuring them, we muſt now proceed to the larger; which more properly belong to chronology, and which muſt be kept on record, as no inſtrument can be made to point them out. Of theſe the diviſion into weeks of ſeven days is one of the moſt ancient, and probably took place from the creation of the world. Some, indeed, are of opinion, that the week was invented ſome time after for the more convenient notation of time; but whatever may be in this, we are certain that it is of the higheſt antiquity, and even the moſt rude and barbarous nations have made uſe of it. It is ſingular indeed that the Greeks, notwithſtanding their learning ſhould have been ignorant of this diviſion; and M. Goguet informs us, that they were almoſt the only nation who were ſo. By them the month of 30 days was divided into three times 10, and the days of it named accordingly. Thus the 15th day of the month was called the *ſecond fifth*, or fifth of the ſecond tenth; the 24th was called the *third fourth*, or the fourth day of the third tenth. This method was in uſe in the days of Heſiod, and it was not until ſeveral ages had elapſed, that the uſe of weeks was received into Greece from the Egyptians. The inhabitants of Cathay, in the northern part of China, were likewiſe unacquainted with the week of ſeven days, but divided the year into ſix parts of 60 days each. They had alſo a cycle of 15 days, which they uſed as a week. The week was likewiſe unknown to the ancient Perſians and to the Mexicans; the former having a different name for every day of the month, and the latter making uſe of a cycle of 13 days. By almoſt all other nations the week of ſeven days was adopted.

17 Of holidays. It is remarkable, that one day in the week has always been accounted as ſacred by every nation. Thus Saturday was conſecrated to pious purpoſes among the Jews, Friday by the Turks, Tueſday by the Africans of Guinea, and Sunday by the Chriſtians. Hence alſo the origin of *Feriæ* or holidays, frequently made uſe of in ſyſtems of Chronology; and which aroſe from the following circumſtance. In the church of Rome the old eccleſiaſtical year began with Eaſter-week; all the days of which were called *Feriæ* or *Feriati*, that is, holy, or ſacred days; and in proceſs of time the days of other weeks came to be diſtinguiſhed by the ſame appellation, for the two following reaſons: 1. Becauſe every day ought to be holy in the eſtimation of a Chriſtian. 2. Becauſe all days are holy to eccleſiaſtics, whoſe time ought to be entirely devoted to religious worſhip.—The term *week* is ſometimes uſed to ſignify ſeven years, not only in the prophetical writings, but likewiſe by profane authors; thus Varro, in his book inſcribed *Hebdomades*, informs, that he had then entered the 12th week of his years.

18 Of months. The next diviſion of time ſuperior to weeks, is that of *months*. This appears to have been, if not coeval with the creation, at leaſt in uſe before the flood. As this diviſion is naturally pointed out by the revolution of the moon, the months of all nations were originally lunar; until after ſome conſiderable advances had been made in ſcience, the revolutions of that luminary were compared with the ſun, and thus the limits of the month fixed with greater accuracy. The diviſion of the year into 12 months, as being founded on the number of full revolutions of the moon in that time, has alſo been very general; though Sir John Chardin informs us, that the Perſians divided the year into 24 months; and the Mexicans into 18 months of 20 days each. The months generally contained 30 days, or 29 and 30 days alternately; though this rule was far from being without exception. The months of the Latins conſiſted of 16, 18, 22, or 36 days; and Romulus gave his people a year of 10 months and 304 days. The Kamtſchadales divide the year into 10 months; reckoning the time proper for labour to be nine months, and the winter ſeaſon, when they are obliged to remain inactive, only as one month.

It has been a very ancient cuſtom to give names to the different months of the year, though this appears to have been more modern than the departure of the Iſraelites out of Egypt, as they would otherwiſe undoubtedly have carried it with them; but for a conſiderable time after their ſettlement in Canaan, they diſtinguiſhed the months only by the names of firſt, ſecond, *&c.* After their return from the Babyloniſh captivity, they adopted the names given to the months by the Chaldæans. Other nations adopted various names, and arranged the months themſelves according to their fancy. From this laſt circumſtance ariſes the variety in the dates of the months; for as the year has been reckoned from different ſigns in the ecliptic, neither the number nor the quantity of months have been the ſame, and their ſituation has likewiſe been altered by the intercalations neceſſary to be made.

Theſe intercalations became neceſſary on account of the exceſs of the ſolar above the lunar year; and the months compoſed of intercalary days are likewiſe called *emboliſmal*. Theſe emboliſmal months are either *natural* or *civil*. By the former, the ſolar and lunar years are adjuſted to one another; and the latter ariſes from the defect of the civil year itſelf. The *ador* of the Jews, which always conſiſts of 30 days, is an example of the natural emboliſmal month.

The Romans had a method of dividing their months into kalends, nones, and ides. The firſt was derived from an old word *calo*, "to call"; becauſe, at every new moon, one of the lower claſs of prieſts aſſembled the people, and called over, or announced, as many days as intervened betwixt that and the nones, in order to notify the difference of times and the return of feſtivals. The 2d, 3d, 4th, 5th, 6th, and 7th of March, May, July, and October, were the nones of theſe months; but in the other months were the 2d, 3d, 4th and 5th days only. Thus the 5th of January was its nones; the 4th was *pridie nonarum;* the third, *tertio nonarum*, &c. The ides contained eight days in every month, and were nine days diſtant from the nones. Thus the 15th day of the four months already mentioned was the ides of them; but in the others the 13th was accounted as ſuch; the 12th was *pridie iduum*, and the 11th *tertio iduum*. The ides were ſucceeded by the kalends; the 14th of January, for inſtance, being the 19th kalend of February; the 15th was the 18th kalend; and ſo on till the 31ſt of January, which was *pridie kalendarum;* and February 1ſt was the kalends.

19 Aſtronomical and civil months. Among the European nations the month is either aſtronomical or civil. The former are meaſured by the motion of the heavenly bodies; the civil conſiſts of a certain number of days ſpecified by the laws, or by the civil inſtitutions of any nation or ſociety. The aſtronomical months, being for the moſt part regulated by the motions of the ſun and moon, are thus divided into ſolar and lunar, of which the former is ſometimes alſo called *civil*. The aſtronomical ſolar month is the

time which the ſun takes up in paſſing through a ſign of the ecliptic. The lunar month is periodical, ſynodical, ſidereal, and civil. The ſynodical lunar month is the time that paſſes between any conjunction of the moon with the ſun and the conjunction following. It includes the motion of the ſun eaſtward during that time; ſo that a mean lunation conſiſts of 29d. 12h. 44′ 2″ 8921. The ſidereal lunar month is the time of the mean revolution of the moon with regard to the fixed ſtars. As the equinoctial points go backwards about 4″ in the ſpace of a lunar month, the moon muſt, in conſequence of this retroceſſion, arrive at the equinox ſooner than at any fixed ſtar, and conſequently the mean ſidereal revolution muſt be longer than the mean periodical one. The latter conſiſts of 27d. 7h. 43′ 4″ 6840. The civil lunar month is computed from the moon, to anſwer the ordinary purpoſes of life; and as it would have been inconvenient, in the computation of lunar months, to have reckoned odd parts of days, they have been compoſed of 30 days, or of 29 and 30 alternately, as the neareſt round numbers. When the month is reckoned from the firſt appearance of the moon after her conjunction, it is called the *month of illumination*. The Arabs, Turks, and other nations, who uſe the era of the Hegira, follow this method of computation. As twelve lunar months however, are 11 days leſs than a ſolar year, Julius Cæſar ordained that the month ſhould be reckoned from the courſe of the ſun, and not of the moon; and that they ſhould conſiſt of 30 and 31 days alternately, February only excepted, which was to conſiſt of 28 days commonly, and of 29 in leap-years.

19
Of years.

The higheſt natural diviſion of time is into years. At firſt, however, it is probable that the courſe of the ſun through the ecliptic would not be obſerved, but that all nations would meaſure their time by the revolutions of the moon. We are certain, at leaſt, that the Egyptian year conſiſted originally of a ſingle lunation; though at length it included two or three months, and was determined by the ſtated returns of the ſeaſons. As the eaſtern nations, however, particularly the Egyptians, Chaldeans, and Indians, applied themſelves in very early periods to aſtronomy, they found, by comparing the motions of the ſun and moon together, that one revolution of the former included nearly 12 of the latter. Hence a year of 12 lunations was formed, in every one of which were reckoned 30 days; and hence alſo the diviſion of the ecliptic into 360 degrees. The luniſolar year, conſiſting of 360 days, was in uſe long before any regular intercalations were made; and hiſtorians inform us, that the year of all ancient nations was luniſolar. Herodotus relates, that the Egyptians firſt divided the year into 12 parts by the aſſiſtance of the ſtars, and that every part conſiſted of 30 days. The Thebans corrected this year by adding 5 intercalary days to it. The old Chaldean year was alſo reformed by the Medes and Perſians; and ſome of the Chineſe miſſionaries have informed us, that the luniſolar year was alſo corrected in China: and that the ſolar year was aſcertained in that country to very conſiderable exactneſs. The Latin year, before Numa's correction of it, conſiſted of 360 days, of which 304 were divided into ten months; to which were added two private months not mentioned in the kalendar.

The imperfection of this method of computing time is now very evident. The luniſolar year was about $5\frac{1}{4}$ days ſhorter than the true ſolar year, and as much longer than the lunar. Hence the months could not long correſpond with the ſeaſons, and even in ſo ſhort a time as 34 years, the winter months would have changed places with thoſe of ſummer. From this rapid variation, Mr Playfair takes notice that a paſſage in Herodotus, by which the learned have been exceedingly puzzled, may receive a ſatisfactory ſolution, *viz.* that "in the time of the ancient Egyptian kings, the ſun had twice ariſen in the place where it had formerly ſet, and twice ſet where it had ariſen." By this he ſuppoſes it is meant, "that the beginning of the year had twice gone through all the ſigns of the ecliptic; and that the ſun had riſen and ſet twice in every day and month of the year." This, which ſome have taken for a proof of moſt extravagant antiquity, he further obſerves, might have happened in 138 years only; as in that period there would be a difference of nearly two years between the ſolar and lunar year. Such evident imperfections could not but produce a reformation every where; and accordingly we find that there was no nation which did not adopt the method of adding a few intercalary days at certain intervals. We are ignorant, however, of the perſon who was the firſt inventor of this method. The Theban prieſts attributed the invention to Mercury or Thoth; and it is certain that they were acquainted with the year of 365 days at a very early period. The length of the ſolar year was repreſented by the celebrated golden circle of Oſymandyas of 365 cubits circumference; and on every cubit of which was inſcribed a day of the year, together with the heliacal riſings and ſettings of the ſtars. The monarch is ſuppoſed to have reigned in the 11th or 13th century before the Chriſtian era.

20
Explanation of a paſſage in Herodotus.

21
Great Egyptian year, or canicular cycle.

The Egyptian ſolar year being almoſt ſix hours ſhorter than the true one, this inaccuracy, in proceſs of time produced another revolution; for ſome circumſtances attending which ſerve to fix the date of the diſcovery of the length of the year, and which from the above deſcription of the golden circle, we may ſuppoſe to have been made during the reign of Oſymandyas. The inundation of the Nile was annually announced by the heliacal riſing of Sirius, to which the reformers of the kalendar adjuſted the beginning of the year, ſuppoſing that it would have remained immoveable. In a number of years, however, it appeared that their ſuppoſitions in this were ill-founded. By reaſon of the inequality abovementioned, the heliacal riſings of Sirius gradually advanced nearly at the rate of one day in four years; ſo that in 1461 years it completed a revolution, by ariſing on every ſucceeding day of the year, and returning to the point originally fixed for the beginning of the year. This period, equal to 1460 Julian years, was termed the *great Egyptian year*, or *canicular cycle*. From the accounts we have of the time that the canicular cycle was renewed, the time of its original commencement may be gathered with tolerable certainty. This happened, according to Cenſorinus, in the 138th year of the Chriſtian æra. Reckoning backward therefore from this time for 1460 years, we come to the year B. C. 1322, when the ſun was in Cancer, about 14 or 15 days after the ſummer ſolſtice

21
Of the time when it commenced.

ſolſtice, which happened on July 5th. The Egyptians uſed no intercalation till the time of Auguſtus, when the corrected Julian year was received at Alexandria by his order; but even this order was obeyed only by the Greeks and Romans who reſided in that city; the ſuperſtitious natives refuſing to make any addition to the length of a year which had been ſo long eſtabliſhed among them.

22 Uncertainty of the time when the true ſolar year was diſcovered.

We are not informed at what preciſe period the true year was obſerved to conſiſt of nearly ſix hours more than the 365 days. Though the prieſts of Thebes claim the merit of the diſcovery, Herodotus makes no mention of it; neither did Thales, who introduced the year of 365 days into Greece, ever uſe any intercalation. Plato and Eudoxus are ſaid to have obtained it as a ſecret from the Egyptians about 80 years after Herodotus, and to have carried it into Greece; which ſhowed, that the knowledge of this form of the year was at that time recent, and only known to a few learned men.

23 Years of the Jews, &c.

The year of the ancient Jews was luniſolar; and we are informed by tradition, that Abraham preſerved in his family, and tranſmitted to poſterity, the Chaldean form of the year, conſiſting of 360 days; which remained the ſame without any correction until the date of the era of Nabonaſſar. The ſolar year was adopted among them after their return from the Babyloniſh captivity; but when ſubjected to the ſucceſſors of Alexander in Syria, they were obliged to admit the lunar year into their kalendar. In order to adjuſt this year to the courſe of the ſun, they added at certain periods a month to Adar, formerly mentioned, and called it *Ve Adar*. They compoſed alſo a cycle of 19 years, in ſeven of which they inſerted the intercalary month. This correction was intended to regulate the months in ſuch a manner, as to bring the 15th of Niſan to the equinoctial point; and likewiſe the courſes of the ſeaſons and feaſts in ſuch a manner, that the corn might be ripe at the paſſover as the law required.

24 Reformation of the kalendar by Julius Cæſar and pope Gregory.

We ſhall not take up the reader's time with any further account of the years made uſe of by different nations, all of which are reſolved at laſt into the luniſolar, it will be ſufficient to mention the improvements in the kalendar made by the two great reformers of it, Julius Cæſar, and Pope Gregory XIII. The inſtitution of the Roman year by Romulus has been already taken notice of; but as this was evidently very imperfect, Numa, on his advancement to the throne, undertook to reform it. With a deſign to make a complete lunar year of it, he added 50 days to the 304 of Romulus; and from every one of his months, which conſiſted of 31 and 30 days, he borrowed one day. Of theſe additional days he compoſed two months; calling the one January, and the other February. Various other corrections and adjuſtments were made; but when Julius Cæſar obtained the ſovereignty of Rome, he found that the months had conſiderably receded from the ſeaſons to which Numa had adjuſted them. To bring them forward to their places, he formed a year of 15 months, or 445 days; which, on account of its length, and the deſign with which it was formed, has been called the *year of confuſion*. It terminated on the firſt of January 45 B. C. and from this period the civil year and months were regulated by the courſe of the ſun. The year of Numa being ten days ſhorter than the ſolar year, two days were added by Julius to every one of the months of January, Auguſt, and December; and one to April, June, September, and November. He ordained likewiſe, that an intercalary day ſhould be added every fourth year to the month of February, by reckoning the 24th day, or ſixth of the kalends of March, twice over. Hence this year was ſtyled *biſſextile*, and alſo *leap-year*, from its leaping a day more than a common year.

The Julian year has been uſed by modern chronologers, as being a meaſure of time extremely ſimple and ſufficiently accurate. It is ſtill, however, ſomewhat imperfect; for as the true ſolar year conſiſts of 365d. 5h. 48′ 45¼″, it appears that in 131 years after the Julian correction, the ſun muſt have arrived one day too ſoon at the equinoctial point. During Cæſar's reign the vernal equinox had been obſerved by Soſigenes on the 25th of March; but by the time of the Nicene council it had gone backward to the 21ſt. The cauſe of the error was not then known; but in 1582, when the equinox happened on the 11th of March it was thought proper to give the kalendar its laſt correction. Pope Gregory XIII. having invited to Rome a conſiderable number of mathematicians and aſtronomers, employed ten years in the examination of their ſeveral formulæ, and at laſt gave the preference to that of Aloſia and Antoninus Lelius, who were brothers. Ten days were now cut off in the month of October, and the 4th of that month was reckoned the 15th. To prevent the ſeaſons from receding in time to come, he ordained that one day ſhould be added every fourth or biſſextile year as before; and that the 1600th year of the Chriſtian era, and every fourth century thereafter, ſhould be a biſſextile or leap year. One day therefore is to be intercalated in the years 2000, 2400, 2800, &c. but in the other centuries, as 1700, 1800, 1900, 2100, &c. it is to be ſuppreſſed and theſe are to be reckoned as common years. Even this correction, however, is not abſolutely exact; but the error muſt be very inconſiderable, and ſcarce amounting to a day and a half in 5000 years.

25 Commencement of the year.

The commencement of the year has been determined by the date of ſome memorable event or occurrence, ſuch as the creation of the world, the univerſal deluge, a conjunction of planets, the incarnation of our Saviour, &c. and of courſe has been referred to different points in the ecliptic. The Chaldæan and the Egyptian years were dated from the autumnal equinox. The eccleſiaſtical year of the Jews began in the ſpring; but in civil affairs, they retained the epoch of the Egyptian year. The ancient Chineſe reckoned from the new moon neareſt to the middle of Aquarius; but, according to ſome recent accounts, the beginning of their year was transferred (B. C. 1740) to the new moon neareſt to the winter ſolſtice. This likewiſe is the date of the Japaneſe year. Diemſchid, or Gemſchid, king of Perſia, obſerved, on the day of his public entry into Perſepolis, that the ſun entered into Aries. In commemoration of this fortunate event and coincidence, he ordained the beginning of the year to be removed from the autumnal to the vernal equinox. This epoch was denominated *Neuruz*, viz. new-day; and is ſtill celebrated with great pomp and feſtivity.

(See Epochs). The ancient Swediſh year commenced at the winter ſolſtice, or rather at the time of the ſun's appearance in the horizon, after an abſence of about 40 days. The feaſt of this epoch was ſolemniſed on the 20th day after the ſolſtice. Some of the Grecian ſtates computed from the vernal, ſome from the autumnal equinox, and others from the ſummer tropic. The year of Romulus commenced in March, and that of Numa in January. The Turks and Arabs date the year from the 16th of July and the American Indians reckon from the firſt appearance of the new moon of the vernal equinox. The church of Rome has fixed new-year's-day on the Sunday that correſponds with the full moon of the ſame ſeaſon. The Venetians, Florentines, and Piſans in Italy, and the inhabitants of Treves in Germany, begin the year at the vernal equinox. The ancient clergy reckoned from the 25th of March; and this method was obſerved in Britain, until the introduction of the new ſtyle (A. D. 1752); after which the year commenced on the 1ſt day of January.

26 Of cycles.

Beſides the natural diviſions of time ariſing immediately from the revolutions of the heavenly bodies, there are others formed from ſome of the leſs obvious conſequences of theſe revolutions, which are called *cycles*, from the Greek κυκλος, *a circle*. The moſt remarkable of theſe are the following.

1. The *cycle of the ſun* is a revolution of 28 years, in which time the days of the months return again to the ſame days of the week; the ſun's place to the ſame ſigns and degrees of the ecliptic on the ſame months and days, ſo as not to differ one degree in 100 years; and the leap-years begin the ſame courſe over again with reſpect to the days of the week on which the days of the months fall.

27 Golden number.

The *cycle of the moon*, commonly called the *golden number*, is a revolution of 19 years; in which time the conjunctions, oppoſitions, and other aſpects of the moon, are within an hour and a half of being the ſame as they were on the ſame days of the months 19 years before. The *indiction* is a revolution of 15 years, uſed only by the Romans for indicating the times of certain payments made by the ſubjects to the republic: It was eſtabliſhed by Conſtantine, A. D. 312.

28 To find the year of any cycle.

The year of our Saviour's birth, according to the vulgar era, was the 9th year of the ſolar cycle, the firſt year of the lunar cycle; and the 312th year after his birth was the firſt year of the Roman indiction. Therefore, to find the year of the ſolar cycle, add 9 to any given year of Chriſt, and divide the ſum by 28, the quotient is the number of cycles elapſed ſince his birth, and the remainder is the cycle for the given year; If nothing remains, the cycle is 28. To find the lunar cycle, add one to the given year of Chriſt, and divide the ſum by 19; the quotient is the number of cycles elapſed in the interval, and the remainder is the cycle for the given year: If nothing remains, the cycle is 19. Laſtly, ſubtract 312 from the given year of Chriſt, and divide the remainder by 15; and what remains after this diviſion is the indiction for the given year: If nothing remains, the indiction is 15.

29 Variation of the golden numbers.

Although the above deficiency in the lunar circle of an hour and an half every 19 years be but ſmall, yet in time it becomes ſo ſenſible as to make a whole natural day in 310 years. So that, although this cycle be of uſe, when the golden numbers are rightly placed againſt the days of the months in the kalendar, as in the Common Prayer Books, for finding the days of the mean conjunctions or oppoſitions of the ſun and moon, and conſequently the time of Eaſter; it will only ſerve for 310 years, old ſtile. For as the new and full moons anticipate a day in that time, the golden numbers ought to be placed one day earlier in the kalendar for the next 310 years to come. Theſe numbers were rightly placed again the days of new moon in the kalendar, By the council of Nice, A. D. 325; but the anticipation, which has been neglected ever ſince, is now grown almoſt into 5 days: And therefore all the golden numbers ought now to be placed five days higher in the kalendar for the old ſtile than they were at the time of the ſaid council; or 6 days lower for the new ſtyle, becauſe at preſent it differs 11 days from the old.

30 To find the golden number.

In the firſt of the following tables the golden numbers under the months ſtand againſt the days of new moon in the left-hand column, for the new ſtyle; adapted chiefly to the ſecond year after leap-year, as being the neareſt mean for all the four; and will ſerve till the year 1900. Therefore to find the day of new moon in any month of a given year till that time, look for the golden number of that year under the deſired month, and againſt it you have the day of new moon in the left hand column. Thus, ſuppoſe it were required to find the day of new moon in September 1789; the golden number for that year is 4, which I look for under December, and right againſt it in the left-hand column you will find 17, which is the day of new moon in that month. *N. B.* If all the golden numbers, except 17, and 6, were ſet one day lower in the table, it would ſerve from the beginning of the year 1900 till the end of the year 2199. The table at the end of this ſection ſhows the golden number for 4000 years after the birth of Chriſt, by looking for the even hundreds of any given year at the left-hand, and for the reſt to make up that year at the head of the table; and where the columns meet, you have the golden number (which is the ſame both in old and new ſtyle) for the given year. Thus, ſuppoſe the golden number was wanted for the year 1789; look for 1700 at the left-hand of the table, and for 89 at the top of it; then guiding your eye downward from 89 to over-againſt 1700, you will find 4, whch is the golden number for that year.

But becauſe the lunar cycle of 19 years ſometimes includes five leap-years, and at other times only four, this table will ſometimes vary a day from the truth in leap-years after February. And it is impoſſible to have one more correct, unleſs we extend it to four times 19 or 76 years; in which there are 19 leap-years without a remainder. But even then to have it of perpetual uſe, it muſt be adapted to the old ſtyle; becauſe, in every centurial year not diviſible by 4, the regular courſe of leap-years is interrupted in the new, as will be the caſe in the year 1800.

31 Dionyſian period, or cycle of Eaſter.

2. The *cycle of Eaſter*, alſo called the *Dionyſian period*, is a revolution of 532 years, found by multiplying the ſolar cycle 28 by the lunar cycle 19. If the new moons did not anticipate upon this cycle, Eaſter-day would al-

always be the Sunday next after the firſt full moon which follows the 21ſt of March. But, on account of the above anticipation, to which no proper regard was had before the late alteration of the ſtyle, the eccleſiaſtic Eaſter has ſeveral times been a week different from the true Eaſter within this laſt century: which inconvenience is now remedied by making the table, which uſed to find Eaſter for ever, in the Common Prayer Book, of no longer uſe than the lunar difference from the new ſtyle will admit of.

The earlieſt Eaſter poſſible is the 22d of March, the lateſt the 25th of April. Within theſe limits are 35 days, and the number belonging to each of them is called the *number of direction*; becauſe thereby the time of Eaſter is found for any given year.

32 Dominical letter.

The firſt ſeven letters of the alphabet are commonly placed in the annual almanacs, to ſhow on what days of the week the days of the months fall throughout the year. And becauſe one of thoſe ſeven letters muſt neceſſarily ſtand againſt Sunday, it is printed in a capital form, and called the *dominical letter;* the other ſix being inſerted in ſmall characters, to denote the other ſix days of the week. Now, ſince a common Julian year contain 365 days, if this number be divided by 7 (the number of days in a week) there will remain one day. If there had been no remainder, it is plain the year would conſtantly begin on the ſame day of the week: but ſince one remains, it is plain, that the year muſt begin and end on the ſame day of the week; and therefore the next year will begin on the day following. Hence, when January begins on Sunday, A is the dominical or Sunday letter for that year: Then, becauſe the next year begins on Monday, the Sunday will fall on the ſeventh day, to which is annexed the ſeventh letter G, which therefore will be the dominical letter for all that year: and as the third year will begin on Tueſday, the Sunday will be on the ſixth day; therefore F will be the Sunday letter for that year. Whence it is evident, that the Sunday letters will go annually in a retrograde order, thus, G, F, E, D, C, B, A. And, in the courſe of ſeven years, if they were all common ones, the ſame days of the week and dominical letters would return to the ſame days of the months. But becauſe there are 366 days in a leap-year, if this number be divided by 7, there will remain two days over and above the 52 weeks of which the year conſiſts. And therefore, if the leap-year begins on Sunday, it will end on Monday; and the next year will begin on Tueſday, the firſt Sunday whereof muſt fall on the ſixth of January, to which is annexed the letter F, and not G, as in common years. By this means, the leap-year returning every fourth year, the order of the dominical letter is interrupted; and the ſeries cannot return to its firſt ſtate till after four times ſeven, or 28 years; and then the ſame days of the months return in order to the ſame days of the week as before.

TABLE I.

Days.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	9		9	17	17	6				11		19
2		17			6	14	14	3	11		19	
3	17	6	17	6			3	11		19	8	8
4	6		6	14	14	3			19	8		16
5		14			3	11	11	19	8		16	
6	14	3	14	3			19			16	5	5
7	3		3	11	11	19		8	16			13
8		11			19	8	8	16	5	5	13	
9	11	19	11	19						13		2
10			19	8	8	16	16	5	13		2	10
11	19	8					5	13	2	2	10	
12	8	16	8	16	16	5				10		18
13					5	13	13	2	10		18	7
14	16	5	16	5			2	10	18	18	7	
15	5		5	13	13	2				7		15
16		13		2	2	10	10	18	7		15	
17	13	2	13			18	18	7		15	4	4
18	2		2	10	10				15			12
19		10		18	18	7	7	15	4	4	12	
20	10	18	10				15			12	1	1
21	18		18	7	7	15		4	12			9
22		7			15	4	4	12	1	1	9	
23	7	15	7	15			12			9	17	17
24			15	4	4	12		1	9			6
25	15	4			12		1	9	17	17	6	
26	4		4	12		1				6		15
27		12		1	1	9	9	17	6		14	
28	12	1	12		9		17	6	14	14	3	3
29	1		1	9		17				3		11
30					17	6	6	14	3		11	
31	9		9				14	3		11		19

TABLE II.

TABLE, *ſhowing the Golden Number, (which is the ſame both in the Old and New Stile), from the Chriſtian Era, to A. D.* 4000.

Hundreds of Years.			Years leſs than an hundred.																		
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
			38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
			57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
			76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
			95	96	97	98	99														
0	1900	3800	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
100	2000	3900	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5
200	2100	4000	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10
300	2200	&c.	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
400	2300	—	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1
500	2400	—	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6
600	2500	—	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11
700	2600	—	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
800	2700	—	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2
900	2800	—	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7
1000	2900	—	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12
1100	3000	—	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	1	15	16	17
1200	3100	—	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3
1300	3200	—	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8
1400	3300	—	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13
1500	3400	—	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1600	3500	—	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4
1700	3600	—	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9
1800	3700	—	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14

33 Julian period.

From the multiplication of the ſolar cycle of 28 years into the lunar cycle of 19 years, and the Roman indiction of 15 years, ariſes the great Julian period, conſiſting of 7980 years, which had its beginning 764 years before Strauchius's ſuppoſed year of the creation (for no later could all the three cycles begin together), and it is not yet completed: And therefore it includes all other cycles, periods, and eras. There is but one year in the whole period that has the ſame numbers for the three cycles of which it is made up: And therefore, if hiſtorians had remarked in their writings the cycles of each year, there had been no diſpute about the time of any action recorded by them.

34 To find the year of the Julian period.

The Dionyſian or vulgar era of Chriſt's birth was about the end of the year of the Julian period 4713: and conſequently the firſt year of his age, according to that account, was the 4714th year of the ſaid period. Therefore, if to the current year of Chriſt we add 4713, the ſum will be the year of the Julian period. So the year 1789 will be found to be the 6502d year of that period. Or, to find the year of the Julian period anſwering to any given year before the firſt year of Chriſt, ſubtract the number of that given year from 4471, and the remainder will be the year of the Julian period. Thus, the year 585 before the firſt year of Chriſt) which was the 584th before his birth) was the 4129th year of the ſaid period. Laſtly, to find the cycles of the ſun, moon, and indiction for any given year of this period, divide the given year by 28, 19, and 15; the three remainders will be the cycles ſought, and the quotients the numbers of cycles run ſince the beginning of the period. So in the above 4714th year of the Julian period, the cycle of the ſun was 10, the cycle of the moon 2, and the cycle of the indiction 4; the ſolar cycle having run through 168 courſes, the lunar 248, and the indiction 314.

35 Year of Chriſt's birth when ſettled.

The vulgar era of Chriſt's birth was never ſettled till the year 527, when Dionyſius Exiguus, a Roman abbot, fixed it to the end of the 4713th year of the Julian period, which was four years too late; for our Saviour was born before the death of Herod, who ſought to kill him as ſoon as he heard of his birth. And, according to the teſtimony of Joſephus (*B.* xvii. *ch.* 8.), there was an eclipſe of the moon in the time of Herod's laſt illneſs; which eclipſe appears by our aſtronomical tables to have been in the year of the Julian period 4710, March 13th, at 3 hours paſt midnight, at Jeruſalem. Now, as our Saviour muſt have been born ſome months before Herod's death, ſince in the interval he was carried into Egypt, the lateſt time in which we can fix the true æra of his birth is about the end of the 4709th year of the Julian period.

36 Eras or Epochs.

As there are certain fixed points in the heavens from which aſtronomers begin their computations, ſo there are certain points of time from which hiſtorians begin to reckon; and theſe points or roots of time are called *eras* or *epochs*. The moſt remarkable eras are, thoſe of the Creation, the Greek Olympiads, the building of Rome, the era or Nabonaſſar, the death of Alexander, the birth of Chriſt, the Arabian Hegira, and the Perſian Jeſdegird: All which, together with ſeveral others of leſs note, have their beginnings fixed by chronologers to the years of the Julian period, to the age of the world at thoſe times, and to the years before and after the year of Chriſt's birth.

37 Hiſtoric chronology

Having thus treated, as fully as our limits will admit, of the various diviſions of time, we muſt now conſider the ſecond part of chronology, *viz.* that which more immediately relates to hiſtory, and which has already been obſerved to have the four following foundations: 1. Aſtronomical obſervations, particularly of eclipſes. 2. The teſtimonies of credible authors. 3. Epochs in hiſtory univerſally allowed to be true. 4. Ancient medals, coins, monuments, and inſcriptions. We ſhall conſider theſe four principal parts in the order they here ſtand.

I.

38 Of eclipſes of the ſun and moon.

It is with great reaſon that the eclipſes of the ſun and moon, and the aſpects of the other planets, have been called public and celeſtial characters of the times, as their calculations afford chronologers infallible proofs of the preciſe epochs in which a great number of the moſt ſignal events in hiſtory have occurred. So that in chronological matters we cannot make any great progreſs, if we are ignorant of the uſe of aſtronomic tables, and the calculation of eclipſes. The ancients regarded the latter as prognoſtics of the fall of empires, of the loſs of battles, of the death of monarchs, *&c.* And it is to this ſuperſtition, to this wretched ignorance, that we happily owe the vaſt labour that hiſtorians have taken to record ſo great a number of them. The moſt able chronologers have collected them with ſtill greater labour. Calviſius, for example, founds his chronology on 144 eclipſes of the ſun, and 127 of the moon, that he ſays he had calculated. The grand conjunction of the two ſuperior planets, Saturn and Jupiter, which, according to Kepler, occurs once in 800 years in the ſame point of the zodiac, and which has happened only eight times ſince the creation (the laſt time in the month of December (1603), may alſo furniſh chronology with incontestable proofs. The ſame may be ſaid of the tranſit of Venus over the ſun, which has been obſerved in our days, and all the other uncommon poſitions of the planets. But among theſe celeſtial and natural characters of times, there are alſo ſome that are named *civil* or *artificial*, and which, nevertheleſs, depend on aſtronomic calculation.

Such are the ſolar and lunar cycles; the Roman indiction; the feaſt of Eaſter; the biſſextile year; the jubilees; the ſabbatic years; the combats and Olympic games of the Greeks; and hegira of the Mahometans, *&c.* And to theſe may be added the periods, eras, epochs, and years of different nations, ancient and modern. We ſhall only remark on this occaſion, that the period or era of the Jews commences with the creation of the world; that of the ancient Romans with the foundation of the city of Rome; that of the Greeks at the eſtabliſhment of the Olympic games; that of Nebuchadnezzar, with the advancement of the firſt king of Babylon to the throne; the Yezdegerdic years, with the laſt king of the Perſians of that name; the hegira of the Turks with the flight of Mahomet from Mecca to Medina, *&c.* The year of the birth of Chriſt was the 4713th year of the Julian period, according to the common method of reckoning. Aſtronomical chronology teaches us to calculate the preciſe year of the Julian period in which each of theſe epochs happened.

II.

39 Of the teſtimony of authors

The teſtimony of authors is the ſecond principal part of hiſtoric chronology. Though no man whatever has a right to pretend to infallibility, or to be regarded as a ſacred oracle, it would, however, be making a very unjuſt judgment of mankind, to treat them all as dupes or impoſtors; and it would be an injury offered to public integrity, were we to doubt the veracity of authors univerſally eſteemed, and of facts that are in themſelves right worthy of belief. It would be even a kind of infatuation to doubt that there have been ſuch cities as Athens, Sparta, Rome, Carthage, *&c.* or that Xerxes reigned in Perſia, and Auguſtus in Rome: whether Hannibal ever was in Italy; or that the emperor Conſtantine built Conſtantinople, *&c.* The unanimous teſtimony of the moſt reſpectable hiſtorians will not admit any doubt of theſe matters. When an hiſtorian is allowed to be completely able to judge of an event, and to have no intent of deceiving by his relation, his teſtimony is irrecuſable. But to avoid the danger of adopting error for truth, and to be ſatisfied of a fact that appears doubtful in hiſtory, we may make uſe of the four following rules, as they are founded in reaſon.

1. We ought to pay a particular regard to the teſtimonies of thoſe who wrote at the ſame time the events happened, and that have not been contradicted by any cotemporary author of known authority. Who can doubt, for example, of the truth of the facts related by admiral Anſon, in the hiſtory of his voyage round the world? The admiral ſaw all the facts there mentioned with his own eyes, and publiſhed his book when two hundred companions of his voyage were ſtill living in London, and could have contradicted him immediately, if he had given any falſe or exaggerated relations.

2. After the cotemporary authors, we ſhould give more credit to thoſe who lived near the time the events happened, than thoſe who lived at a diſtance.

3. Thoſe doubtful hiſtories, which are related by authors that are but little known, can have no weight if they are at variance with reaſon, or eſtabliſhed tradition.

4. We muſt diſtruſt the truth of a hiſtory that is related by modern authors, when they do not agree among themſelves in ſeveral circumſtances, nor with ancient hiſtorians, who are to be regarded as original ſources. We ſhould eſpecially doubt the truth of thoſe brilliant portraits, that are drawn at pleaſure by ſuch as never knew the perſons they are intended for, and even made ſeveral centuries after their deceaſe.

The moſt pure and moſt fruitful ſource of ancient hiſtory is doubtleſs to be found in the Holy Bible. Let us here for a moment ceaſe to regard it as divine, and let us preſume to conſider it as a common hiſtory. Now, when we regard the writers of the books of the Old Teſtament, and conſider them ſometimes as authors, ſometimes as ocular witneſſes, and ſometimes as reſpectable hiſtorians; whether we reflect on the ſimplicity of the narration, and the air of truth that is there conſtantly viſible; or, when we conſider the care that the people, the governments, and the learned men of all ages, have taken to preſerve the true text of the Bible; or that we have regard to the happy conformity of the chronology of the holy ſcriptures with that of profane hiſtory: or, if we obſerve the admirable harmony that is between theſe books and the moſt reſpectable hiſtorians, as Joſephus and others: and laſtly, when we conſider that the books of the holy ſcripture furniſh us alone with an accurate hiſtory of the world from the creation, through the line of patriarchs, kings, judges, and princes of the Hebrews; and that we may, by its aid, form an almoſt intire ſeries of events down to the birth of Chriſt, or the time of Auguſtus, which comprehends a ſpace of about 4000 years, ſome ſmall interruptions excepted, and which are eaſily ſupplied by profane hiſtory: when all theſe reflections are juſtly made, we muſt conſtantly allow that the ſcriptures form a book which merits the firſt rank among all the ſources of ancient hiſtory. It has been objected, that this book contains contradictions; but the moſt able interpreters have reconciled theſe ſeeming contradictions. It has been ſaid, that the chronology of the Hebrew text and the Vulgate do not agree with the chronology of the verſion of the Septuagint; but the ſoundeſt critics have ſhown that they may be made to agree. It has been obſerved, moreover, that the ſcriptures abound with miracles and prodigies; but they are miracles that have really happened: and what ancient hiſtory is there that is not filled with miracles, and other marvellous events? And do we for that reject their authority? Cannot the true God be ſuppoſed to have performed thoſe miracles which Pagan hiſtorians have attributed to their falſe divinities? Muſt we pay no regard to the writings of Livy, becauſe his hiſtory contains many fabulous relations?

III.

40 Epochs. THE *epochs* form the third principal part of chronology. Theſe are thoſe fixed points in hiſtory that have never been conteſted, and of which there can, in fact, be no doubt. Chronologers fix on the events that are to ſerve as epochs, in a manner quite arbitrary; but this is of little conſequence, provided the dates of theſe epochs agree, and that there is no contradiction in the facts themſelves. When we come to treat expreſsly on hiſtory, we ſhall mention, in our progreſs, all the principal epochs.

IV.

41 Medals, &c. MEDALS, monuments, and inſcriptions, form the fourth and laſt principal part of chronology. It is ſcarce more than 150 years ſince cloſe application has been made to the ſtudy of theſe; and we owe to the celebrated Spanheim the greateſt obligations, for the progreſs that is made in this method: his excellent work, *De præſtantia et uſu numiſmatum antiquorum*, has ſhown the great advantages of it; and it is evident that theſe monuments are the moſt authentic witneſſes that can be produced. It is by the aid of medals that M. Vailant has compoſed his judicious hiſtory of the kings of Syria, from the time of Alexander the Great to that of Pompey: they have been, moreover, of the greateſt ſervice in elucidating all ancient hiſtory, eſpecially that of the Romans; and even ſometimes that of the middle age. Their uſe is more fully ſpoken of in the article MEDALS. What we here ſay of medals, is to be underſtood equally, in its full force, of ancient inſcriptions, and of all other authentic monuments that have come down to us.

Every reader, endowed with a juſt diſcernment will readily allow that theſe four parts of chronology afford clear lights, and are excellent guides to conduct us through the thick darkneſs of antiquity. That impartiality, however, which directs us to give a faithful relation of that which is true and falſe, of the certainty and uncertainty of all the ſciences, obliges us here freely to confeſs, that theſe guides are not infallible, nor the proofs that they afford mathematical demonſtrations. In fact, with regard to hiſtory in general, and ancient hiſtory in particular, ſomething muſt be always left to conjecture and hiſtoric faith. It would be an offence againſt common probity, were we to ſuffer ourſelves to paſs over in ſilence thoſe objections which authors of the greateſt reputation have made againſt the certainty of chronology. We ſhall extract them from their own works; and we hope that their is no magiſtrate, theologian, or public profeſſor in Europe, who would be mean enough to accuſe us of a crime, for not unworthily diſguiſing the truth.

1. The prodigious difference there is between the Septuagint Bible and the Vulgate, in point of chronology, occaſions an embarraſſment, which is the more difficult to avoid as we cannot poſitively ſay on which ſide the error lies. The Greek Bible counts, for example, from the creation of the world to the birth of Abraham, 1500 years more than the Hebrew and Latin Bibles, *&c.* 2. How difficult is it to aſcertain the years of the judges of the Jewiſh nation, in the Bible? What darkneſs is ſpread over the ſucceſſion of the kings of Judah and Iſrael? The calculation of time is there ſo inaccurate, that the ſcripture never marks if they are current or complete years. For we cannot ſuppoſe that a patriarch, judge, or king, lived exactly 60, 90, 100, or 969 years, without any odd months or days. 3. The different names that the Aſſyrians, Egyptains, Perſians and Greeks, have given to the ſame prince, have contributed not a little to embarraſs all ancient chronology. Three or four princes have borne the name of Aſſuerus, though they had alſo other names. If we did not know that Nabucodonoſor, Nabucodroſor, and Nabucolaſſar, were the ſame name, or the name of the ſame man, we ſhould ſcarcely believe it. Sargon is Senacherib; Ozias is Azarias; Sedecias is Mathanias; Joachas is alſo called Sellum; Aſaraddon, which is pronounced indifferently Eſarhaddon and Aſarhaddon, is called Aſenaphar by the Cuthæans; and by an oddity of which we do not know the origin, Sardanapalus is called

by the Greeks Tenos Concoleros. 4. There remain to us but few monuments of the firſt monarchs of the world. Numberleſs books have been loſt, and thoſe which have came down to us are mutilated or altered by tranſcribers. The Greeks began to write very late. Herodotus, their firſt hiſtorian, was of a credulous diſpoſition, and believed all the fables that were related by the Egyptain prieſts. The Greeks were in general vain, partial, and held no nation in eſteem but their own. The Romans were ſtill more infatuated with notions of their own merit and grandeur, their hiſtorians were altogether as unjuſt as was their ſenate, toward other nations that were frequently far more reſpectable. 5. The eras, the years, the periods and epochs, were not the ſame in each nation; and they, moreover, began at different ſeaſons of the year. All this has thrown ſo much obſcurity over chronology, that it appears to be beyond all human capacity totally to diſperſe it.

Chriſtianity itſelf had ſubſiſted near 1200 years, before they knew preciſely how many years had paſſed ſince the birth of our Saviour. They ſaw clearly that the vulgar era was defective, but it was a long time before they could comprehend that it required four whole years to make up the true period. Abbe Denis the Little, who in the year 532 was the firſt among the Chriſtians to form the era of that grand epoch, and to count the years from that time, in order to make their chronology altogether Chriſtian, erred in his calculation, and led all Europe into his error. They count 132 contrary opinions of different authors concerning the year in which the Meſſiah appeared on the earth. M. Vallemont names 64 of them, and all celebrated writers. Among all theſe authors, however, there is none that reckon more than 7000, nor leſs than 3700 years. But even this difference is enormous. The moſt moderate fix the birth of Chriſt in the 4000th year of the world. The reaſons, however, on which they found their opinion, appear to be ſufficiently arbitrary.

Be theſe matters, however, as they may, the wiſdom of Providence has ſo diſpoſed all things, that there remain ſufficient lights to enable us nearly to connect the ſeries of events: for in the firſt 3000 years of the world, where profane hiſtory is defective we have the chronology of the Bible to direct us; and after that period, where we find more obſcurity in the chronology of the holy ſcriptures, we have, on the other hand, greater lights from profane authors. It is at this period that begins the time which Varro calls *hiſtoric*: as, ſince the time of the Olympiads, the truth of ſuch events as have happened ſhines clear in hiſtory. Chronology, therefore, draws its principal lights from hiſtory; and in return, ſerves it as a guide. Referring the reader, therefore, to the article HISTORY, and the *Chart* thereto annexed, we ſhall conclude the preſent article with

A CHRONOLOGICAL TABLE *of Remarkable Events, Diſcoveries, and Inventions, from the Creation to the Year* 1789.

Bef. Chriſt.

4008 THE creation of the world, and Adam and Eve

4007 The birth of Cain, the firſt who was born of a woman.

3017 Enoch, for his piety, is tranſlated to heaven.

2352 The old world is deſtroyed by a deluge which continued 377 days.

2247 The tower of Babel is built about this time by Noah's poſterity; upon which God miraculouſly confounds their language, and thus diſperſes them into different nations.

2237 About this time, Noah is, with great probability, ſuppoſed to have parted from his rebellious offspring, and to have led a colony of ſome of the more tractable into the eaſt, and there either he, or one of his ſucceſſors to have founded the ancient Chineſe monarchy.

2234 The celeſtial obſervations are begun at Babylon, the city which firſt gave birth to learning and the ſciences.

2188 Miſraim, the ſon of Ham, founds the kingdom of Egypt, which laſted 1663 years, down to the conqueſt of Cambyſes, in 525 before Chriſt.

2059 Ninus, the ſon of Belus, founds the kingdom of Aſſyria, which laſted above 1000 years, and out of its ruins were formed the Aſſyrians of Babylon, thoſe of Nineveh, and the kingdom of the Medes.

1985 The covenant of God made with Abram, when he leaves Haran to go into Canaan, which begin, the 430 years of ſojourning.

1961 The cities of Sodom and Gomorra are deſtroyed for their wickedneſs by fire from heaven.

1856 The kingdom of Argos, in Greece, begins under Inachus.

1822 Memnon, the Egyptain, invents the letters.

1715 Prometheus firſt ſtruck fire from flints.

1635 Joſeph dies in Egypt.

1574 Aaron born in Egypt; 1490, appointed by God firſt high-prieſt of the Iſraelites..

1571 Moſes, brother to Aaron, born in Egypt, and adopted by Pharaoh's daghter, who educates him in all the learning of the Egyptains.

1556 Cecrops brings a colony of Saites from Egypt into Attica, and begins the kingdom of Athens in Greece.

1555 Moſes performs a number of miracles in Egypt; and departs from that kingdom, together with 600,000 Iſraelites, beſides children, which completed the 430 years of ſojourning. They miraculouſly paſs through the Red Sea, and come to the deſart of Sinai, where Moſes receives from God, and delivers to the people, the Ten Commandments, and the other laws, and ſets up the tabernacle, and in it the ark of the covenant.

1546 Scamander comes from Crete into Phrygia, and begins the kingdom of Troy.

1515 The Iſraelites, after ſojourning in the wilderneſs forty years, are led under Joſhua into the land of Canaan, where they fix themſelves, after having ſubdued the natives; and the period of the ſabbatical year commences.

1503 The deluge of Deucalion.

1496 The council of Amphictyons eſtabliſhed at Thermopylæ.

1493 Cadmus carried the Phenician letters into Greece and built the citadel of Thebes.

1490 Sparta built by Lacedemon.

1485 The firſt ſhip that appeared in Greece was brought from Egypt by Danaus, who arrived at Rhodes, and brought with him his fifty daughters.
1480 Troy built by Dardanus.
1452 The Pentateuch, or five firſt books of Moſes, are written in the land of Moab, where he died the year following, aged 110.
1406 Iron is found in Greece, from the accidental burning of the woods.
1344 The kingdom of Mycenæ begins.
1326 The Iſthmian games inſtituted at Corinth.
1325 The Egyptian canicular year began July 20th.
1307 The Olympic games inſtituted by Pelops.
1300 The Lupercalia inſtituted.
1494 The firſt colony came from Italy into Sicily.
1264 The ſecond colony came from Italy into Sicily.
1252 The city of Tyre built.
1243 A colony of Arcadians conducted by Evander into Italy.
1233 Carthage founded by the Tyrians.
1225 The Argonautic expedition.
1204 The rape of Helen by Paris, which gave riſe to the Trojan war, ending with the deſtruction of the city in 1184.
1176 Salamis in Cyprus built by Teucer.
1152 Aſcanius builds Alba Longa.
1130 The kingdom of Sicyon ended.
1124 Thebes built by the Boeotians.
1115 The mariner's compaſs known in China.
1104 The expedition of the Heraclidæ into Peloponneſus; the migration of the Dorians thither; and the end of the kingdom of Mycenæ.
1102 The kingdom of Sparta commenced.
1070 The kingdom of Athens ended.
1051 David beſieged and took Jeruſalem.
1044 Migration of the Ionian colonies.
1008 The Temple is ſolemnly dedicated by Solomon.
996 Solomon prepared a fleet on the Red Sea to ſend to Ophir.
986 Samos and Utica in Africa built.
979 The kingdom of Iſrael divided.
974 Jeruſalem taken and plundered by Shiſhak king of Egypt.
911 The prophet Elijah flouriſhed.
894 Money firſt made of gold and ſilver at Argos.
884 Olympic games reſtored by Iphitus and Lycurgus.
873 The art of ſculpture in marble found out.
869 Scales and meaſures invented by Phidon.
864 The city of Carthage, in Africa, enlarged by queen Dido.
821 Nineveh taken by Arbaces.
814 The kingdom of Macedon begins.
801 The city of Capua in Compania built.
799 The kingdom of Lydia began.
786 The ſhips called *Triremes* invented by the Corinthians.
779 The race of kings in Corinth ended.
776 The era of the Olympiads began.
760 The Ephori eſtabliſhed at Sparta.
758 Syracuſe built by Archias of Corinth.
754 The government of Athens changed.
753 Era of the building of Rome in Italy by Romulus, firſt king of the Romans.
747 The era of Nabonaſſar commenced on the 26th of February; the firſt day of Thoth.
746 The government of Corinth changed into a republic.
743 The firſt war between the Meſſenians and Spartans.
724 Mycenæ reduced by the Spartans.
723 A colony of the Meſſenians ſettled at Rhegium in Italy.
720 Samaria taken, after three years ſiege, and the kingdom of Iſreal finiſhed by Salmanazer king of Aſſyria, who carries the ten tribes into captivity.
The firſt eclipſe of the moon on record.
713 Gela in Sicily built.
703 Corcyra, now Corfu, founder of the Corinthians.
702 Ecbatan in Media built by Deioces.
685 The ſecond Meſſenian war under Ariſtomenes.
670 Byzantium (now Conſtantinople) built by a colony of Athenians.
666 The city of Alba deſtroyed.
648 Cyrene in Africa founded.
634 Cyaxares beſieges Nineveh, but is obliged to raiſe the ſiege by an incurſion of the Scythians, who remained maſters of Aſia for 28 years.
624 Draco publiſhed his inhuman laws at Athens.
610 Pharaoh Necho attempted to make a canal from the Nile to the Red Sea, but was not able to accompliſh it.
607 By order of the ſame monarch, ſome Phenicians ſailed from the Red Sea round Africa, and returned by the Mediterranean.
606 The firſt captivity of the Jews by Nebuchadnezzar. Nineveh deſtroyed by Cyaxares.
600 Thales, of Miletus, travels into Egypt, conſults the prieſts of Memphis, acquires the knowledge of geometry, aſtronomy, and philoſophy; returns to Greece, calculates eclipſes, gives general notions of the univerſe, and maintains that an only Supreme Intelligence regulates all its motions.
Maps, globes, and the ſigns of the zodiac, invented by Anaximander, the ſcholar of Thales.
598 Jehoiakin, king of Judah, is carried away captive, by Nebuchadnezzar, to Babylon.
594 Solon made Archon at Athens.
591 The Pythian games inſtituted in Greece, and tragedy firſt acted.
588 The firſt irruption of the Gauls into Italy.
586 The city of Jeruſalem taken, after a ſiege of 18 months.
582 The laſt captivity of the Jews by Nebuchadnezzar.
581 The Iſthmian games reſtored.
580 Money firſt coined at Rome.
571 Tyre taken by Nebuchadnezzar after a ſiege of 13 years.
566 The firſt cenſus at Rome, when the number of citizens was found to be 84,000.
562 The firſt comedy at Athens acted upon a moveable ſcaffold.
559 Cyrus the firſt king of Perſia.
538 The kingdom of Babylon finiſhed; that city being

ing taken by Cyrus, who, in 536, gives an edict for the return of the Jews.
534 The foundation of the temple laid by the Jews.
526 Learning is greatly encouraged at Athens, and a public library firſt founded.
520 The ſecond edict to rebuild Jeruſalem.
515 The ſecond temple at Jeruſalem is finiſhed under Darius.
510 Hippias baniſhed from Athens.
509 Tarquin, the ſeventh and laſt king of the Romans, is expelled, and Rome is governed by two conſuls, and other republican magiſtrates, till the battle of Pharſalia, being a ſpace of 461 years.
508 The firſt alliance between the Romans and Carthaginians.
507 The ſecond cenſus at Rome, 130,000 citizens.
504 Sardis taken and burnt by the Athenians, which gave occaſion to the Perſian invaſion of Greece.
498 The firſt dictator appointed at Rome.
497 The Saturnalia inſtituted at Rome.
The number of citizens 150,700.
493 Tribunes created at Rome; or, in 488.
490 The battle of Marathon, September 28th.
486 Æſchylus, the Greek poet, firſt gains the prize of tragedy.
483 Queſtors created at Rome.
481 Xerxes, king of Perſia, begins his expedion againſt Greece.
480 The defence of Thermopylæ by Leonidas, and the ſea-fight at Salamis.
476 The number of Roman citizens reduced to 103,000
469 The third Meſſenian war.
466 The number of Roman citizens increaſed to 124,214.
458 Ezra is ſent from Babylon to Jeruſalem, with the captive Jews and the veſſels of gold and ſilver, &c. being ſeventy weeks of years, or 490 years before the crucifixion of our Saviour.
456 The Ludi Seculares firſt celebrated at Rome.
454 The Romans ſend to Athens for Solon's laws.
451 The Decemvirs created at Rome, and the laws of the twelve tables compiled and ratified.
449 The Decemvirs baniſhed.
445 Military tribunes, with conſular power, created at Rome.
443 Cenſors created at Rome.
441 The battering Ram invented by Artemones.
432 The Metonic cycle began July 15th.
431 The Peloponneſian war began, and laſted 27 years.
430 The hiſtory of the Old Teſtament finiſhes about this time.
A plague over the known world.
Malachi the laſt of the prophets.
405 The Athenians entirely defeated by Lyſander, which occaſions the loſs of the city, and ruin of the Athenian power.
401 The retreat of the 10,000 Greeks under Xenophon. The 30 tyrants expelled from Athens, and democratic government reſtored.
400 Socrates, the founder, of moral philoſophy among the Greeks, believes the immortality of the ſoul, a ſtate of rewards and puniſhments; for which, and other ſublime doctrines, he is put to death by the Athenians, who ſoon after repent, and erect to his memory a ſtatue of braſs.
399 The feaſt of Lectiſternium inſtituted. Catapultæ invented by Dionyſius.
394 The Corinthian war begun.
390 Rome burnt by the Gauls.
387 The peace of Antalcidas between the Greeks and Perſians.
The number of Roman citizens amounted to 152,583.
384 Dionyſius begins the Punic war.
379 The Bœtian war commences.
377 A general conſpiracy of the Greek ſtates againſt the Lacedemonians.
373 A great earthquake in Peloponneſus.
371 The Lacedemonians defeated by Epaminondas at Leuctra.
367 Prætors eſtabliſhed in Rome. The Licinian law paſſed.
363 Epaminondas killed at the battle of Mantinea.
359 The obliquity of the ecliptic obſerved to be 23° 49′ 10″.
358 The Social war began.
357 Dionyſius expelled from Syracuſe.
A tranſit of the moon over Mars obſerved.
356 The ſacred war begun in Greece.
Birth of Alexander the Great.
343 Dionyſius II. expelled from Syracuſe.
Commencement of the Syracuſian era.
338 Philip of Macedon gains the battle of Chæronæa, and thus attains to the Sovereignty of Greece.
335 Thebes taken and raſed by Alexander the Great.
334 The Perſians defeated at Granicus, May 22d.
333 They are again defeated at Iſſus in Cilicia, October.
332 Alexander takes Tyre and marches to Jeruſalem.
331 Alexandria built.
Darius entirely defeated at Arbela.
330 Alexander takes Babylon, and the principal cities of the Perſian Empire.
The Calippic period commences.
328 Alexander paſſes Mount Caucaſus, and marches into India.
327 He defeats Porus, an Indian prince, and founds ſeveral cities.
326 The famous ſedition of Corcyra.
324 His family exterminated, and his dominions parted by his officers.
323 Alexander the Great dies at Babylon.
315 Rhodes almoſt deſtroyed by an inundation.
311 The Appian way, aqueducts, &c. conſtructed at Rome.
308 The cities of Greece recovered their liberties for a ſhort time.
307 Antioch, Seleucia, Laodicea, and other cities, founded by Seleucus.
301 Antigonus defeated and killed at Ipſus.
299 The firſt barbers came from Sicily to Rome.
294 The number of effective men in Rome amounts to 270,000.
293 The firſt ſun-dial erected at Rome by Papirius Curſor.

285 Dionyſius, of Alexandria, began his aſtronomical era on Monday June 26, being the firſt who found the exact ſolar year to conſiſt of 365 days 5 hours and 49 minutes.
The watch tower of Pharos at Alexandria built.
Ptolemy Philadelphus, king of Egypt, employs 72 interpreters to tranſlate the Old Teſtament into the Greek languages, which is called the *Septuagint*.
284 The foundations of the Achæan republic laid.
283 The college and library founded at Alexandria.
282 The Tarentine war begins.
280 Pyrrhus invades Italy.
279 A cenſus at Rome. The number of citizens 278,222.
269 The firſt coining of ſilver at Rome.
265 The number of Roman citizens augmented to 292,224.
264 The firſt Punic war begins, and continues 23 years. The Chronology of the Arundelian marbles compoſed.
262 A tranſit of Mercury over the Bull's horn; the planet being in 23° of ♉, and the ſun in 29° 30′ ♈.
260 Provincial queſtors eſtabliſhed at Rome.
The Romans firſt concern themſelves in naval affairs, and defeat the Carthaginians at ſea.
255 Regulus, the Roman Conſul, defeated and taken priſoner by the Carthaginians under Xantippus.
252 A cenſus at Rome. The number of citizens 297.897.
247 Another cenſus. The number of citizens, 251,212,
246 The records of China deſtroyed.
241 Concluſion of the firſt Punic war.
240 Comedies firſt acted at Rome.
237 Hamilcar, the Carthaginian, cauſes his ſon Hannibal, at nine years old, to ſwear eternal enmity to the Romans.
236 The Tartars expelled from China.
235 Rome at peace with other nations. The temple of Janus ſhut.
231 Corſica and Sardinia ſubdued by the Romans.
The firſt divorce at Rome.
230 The obliquity of the ecliptic obſerved by Eratoſthenes to be 23° 51′ 20″.
224 The Coloſſus at Rhodes overturned by an earthquake.
219 The art of ſurgery introduced at Rome.
218 Commencement of the ſecond Punic war.
Hannibal paſſes the Alps and invades Italy.
216 The Romans defeated at Cannæ, May 21ſt.
214 Syracuſe beſieged by Marcellus.
209 A cenſus at Rome. The number of citizens 227,107.
208 Aſdrubal invades Italy; but is defeated and killed.
206 Gold firſt coined at Rome.
202 Hannibal defeated by Scipio at Zama.
201 Concluſion of the ſecond Punic war.
194 Sparta and Hither Spain ſubdued by the Romans.
192 A cenſus at Rome. The number of citizens 243,704.
191 Antiochus defeated by the Romans at Thermopylæ.
190 The firſt Roman army enters Aſia, and from the ſpoils of Antiochus brings the Aſiatic luxury firſt to Rome.
188 The Spartans obliged to renounce the inſtitutions of Lycurgus.
179 A cenſus at Rome. The number of citizens 273,244.
173 The Jewiſh high-prieſthood ſold by Antiochus Epiphanes.
170 Paper invented in China.
The temple of Jeruſalem plundered by Antiochus.
169 A cenſus at Rome. The number of citizens 212,805.
168 Macedon reduced to the form of a Roman province.
The firſt library erected at Rome.
165 The temple of Jeruſalem purified by Judas Maccabeus.
164 A cenſus at Rome. The number of citizens 327,032.
162 Hipparchus began his aſtronomical obſervations at Rhodes.
161 Philoſophers and rhetoricians baniſhed from Rome.
150 The third Punic war commenced.
146 Corinth deſtroyed.
Carthage, the rival to Rome, is raſed to the ground by the Romans.
A remarkable comet appeared in Greece.
143 Hipparchus began his new cycle of the moon, conſiſting of 111,035 days.
141 The Numantine war commenced.
135 The hiſtory of the Apocrypha ends.
133 Numantia deſtroyed by Scipio.
124 A cenſus at Rome. The number of citizens 390,736.
105 The Cimbri and Tuetones defeated the Romans.
102 The Tuetones and Ambrones defeated by Marius.
88 Rome beſieged by the chiefs of the Marian faction.
82 Sylla created perpetual dictator at Rome.
69 A cenſus at Rome. The number of citizens 450,000.
66 Cataline's conſpiracy.
55 Julius Cæſar makes his firſt expedition into Britain.
Craſſus defeated and killed by the Parthians.
51 Gaul reduced to a Roman province.
50 A cenſus at Rome. The number of citizens 320,000.
48 The battle of Pharſalia, between Cæſar and Pompey, in which the latter is defeated.
The Alexandrian library, conſiſting of 400,000 valuable books, burnt by accident.
45 The war of Africa, in which Cato kills himſelf.
The ſolar year introduced by Cæſar.
44 Cæſar, the greateſt of the Roman conquerors, after having fought fifty pitched battles, and ſlain 1,192,000 men, is killed in the ſenate-houſe by conſpirators.
42 The republicans defeated at Philippi.
31 The battle of Actium fought, in which Mark

Anthony and Cleopatra are totally defeated by Octavius, nephew to Julius Cæſar.

30 Alexandria, in Egypt, is taken by Octavius, upon which Anthony and Cleopatra put themſelves to death, and Egypt is reduced to a Roman province.

29 A cenſus at Rome. The number of citizens 4,101,017.

27 Octavius, by a decree of the ſenate, obtains the title of Auguſtus Cæſar, and an abſolute exemption from the laws, and is properly the firſt Roman emperor.

The pantheon at Rome built.

19 Rome at the height of its glory.

The temple of Jeruſalem rebuilt by Herod.

Agrippa conſtructed the magnificent aqueducts at Rome.

8 A cenſus at Rome. The number of citizens 4,233,000.

5 The temple of Janus is ſhut by Auguſtus, as an emblem of univerſal peace, and

JESUS CHRIST is born, on Monday, December 25.

After Chriſt.

1 The Vulgar Chriſtian era commenced from January; the Saviour of the world being then five years of age.

8 Jeſus Chriſt diſputes with the doctors in the temple.

14 A cenſus at Rome, 4,037,000 citizens.

16 Mathematicians and magicians expelled from Rome.

17 Twelve cities in Aſia deſtroyed by an earthquake.

27 Pilate made governor of Judæa.

29 Jeſus baptiſed in Jordan by John.

33 He is crucified at Jeruſalem.

35 St Paul converted.

39 St Matthew writes his Goſpel.

Pontius Pilate kills himſelf.

A conjunction of Saturn, Jupiter, and Mars.

40 The name of Chriſtians firſt given at Antioch to the followers of Chriſt.

43 Claudius Cæſar's expedition into Britain.

44 St Mark writes his Goſpel.

50 London is founded by the Romans: 368, ſurrounded by ditto with a wall, ſome parts of which are ſtill obſervable.

51 Caractacus, the Britiſh king, is carried in chains to Rome.

52 The council of the Apoſtles at Jeruſalem.

55 St Luke writes his Goſpel.

56 Rotterdam built.

59 The emperor Nero puts his Mother and brothers to death.

————Perſecutes the Druids in Britain.

60 Chriſtianity introduced into Britain.

61 Boadicia, the Britiſh queen, defeats the Romans; but is conquered ſoon after by Suetonius, gogernor of Britain.

62 St Paul is ſent in bonds to Rome—writes his epiſtles between 51 and 66.

63 The Acts of the Apoſtles written.

A great earthquake in Aſia.

64 Rome ſet on fire, and burned for ſix days; upon which began (under Nero) the firſt perſecution againſt the Chriſtians.

65 Many prodigies ſeen about Jeruſalem.

66 St Peter and St Paul put to death.

70 While the factious Jews are deſtroying one another with mutual fury, Titus, the Roman general, takes Jeruſalem, which is raſed to the ground, and the plough made to paſs over it.

73 The philoſophers baniſhed from Rome by Veſpaſian.

79 The cities of Pompeii and Herculaneum deſtroyed by an eruption of Veſuvius.

80 The Capitol and Pantheon at Rome deſtroyed by fire.

83 The philoſophers expelled Rome by Domitian.

85 Julius Agricola, governor of South-Britain, to protect the civilized Britons from the incurſions of the Caledonians, builds a line of forts between the rivers Forth and Clyde; defeats the Caledonians under Galgacus on the Grampian hills; and firſt ſails round Britain, which he diſcovers to be an iſland.

86 The Capitoline games inſtituted by Domitian.

88 The ſecular games celebrated at Rome.

93 The empire of the Huns in Tartary deſtroyed by the Chineſe.

The Evangeliſt John baniſhed to Patmos.

94 The ſecond Perſecution of the Chriſtians under Domitian.

96 St John the Evangeliſt wrote his Revelation—his Goſpel in 97.

103 Dacia reduced to a Roman province.

105 A great earthquake in Aſia and Greece.

107 The third perſecution of the Chriſtians under Trajan.

114 Armenia reduced to a Roman province.

A great earthquake in China.

115 Aſſyria ſubdued by Trajan.

An inſurrection of the Jews, who murder 200,000 Greeks and Romans.

A violent earthquake at Antioch.

120 Nicomedia and other cities ſwallowed up by an earthquake.

121 The Caledonians reconquer from the Romans all the ſouthern parts of Scotland; upon which the emperor Adrian builds a wall between Newcaſtle and Carliſle; but this alſo proving ineffectual, Pollius Urbicus, the Roman general, about the year 134, repairs Agricola's forts, which he joins by a wall four yards thick.

130 Jeruſalem rebuilt by Adrian.

132 The ſecond Jewiſh war commenced.

135 The ſecond Jewiſh war ends, when they were all baniſhed Judea.

139 Juſtin writes his firſt apology for the Chriſtians.

141 A number of hereſies appear about this time.

146 The worſhip of Serapis introduced at Rome.

152 The emperor Antoninus Pius ſtops the perſecution againſt the Chriſtians.

An inundation of the Tyber, and an earthquake at Rhodes.

163 The fourth perſecution of the Chriſtians, under Marcus Aurelius Antoninus.

166 The Romans ſent Ambaſſadors to China.

168 A plague over the known world.
188 The Capitol at Rome deſtroyed by lightning.
191 A great part of Rome deſtroyed by fire.
203 The fifth perſecution of the Chriſtians, under Severus.
205 An earthquake in Wales.
209 Severus's wall in Britain built.
218 Two comets appeared at Rome. The courſe of the moſt remarkable from eaſt to weſt.
222 About this time the Roman empire begins to decline. The Barbarians begin their irruptions, and the Goths have annual tribute not to moleſt the empire.
225 Mathematicians allowed to teach publicly at Rome.
236 The ſixth perſecution of the Chriſtians, under Maximin.
241 The Franks firſt mentioned in hiſtory.
250 The ſeventh perſecution, under Decius.
252 A dreadful peſtilence broke out in Ethiopia, and ſpread over the world.
The eighth perſecution, under Gallus.
253 Europe ravaged by the Scythians and Goths.
258 The ninth perſecution, under Valerian.
260 Valerian is taken priſoner by Sapor, king of Perſia, and flead alive.
The Scythians ravaged the Roman empire
The temple of Diana at Epheſus burnt.
261 A great plague throughout the Roman empire.
262 Earthquakes in Europe, Aſia, and Africa, and three days of darkneſs.
273 The Romans took Palmyra.
274 Silk firſt brought from India; the manufactory of it introduced into Europe by ſome monks, 551; firſt worn by the clergy in England, 1534.
276 Wines firſt made in Britain.
277 The Franks ſettled in Gaul.
284 The Diocleſian era commenced auguſt 29th, or September 17th.
287 Carauſius proclaimed emperor of Britain.
289 A great comet viſible in Meſopotamia for 29 days.
291 Two emperors and two Cæſars march to defend the four quarters of the empire.
297 Alexandria deſtroyed by Diocleſian.
303 The tenth perſecution, under Diocleſian.
306 Conſtantine the Great begins his reign.
308 Cardinals firſt began.
312 Peſtilence all over the Eaſt.
Cycle of induction began.
313 The tenth perſecution ends by an edict of Conſtantine, who favours the Chriſtians, and gives full liberty to their religion.
314 Three biſhops, or fathers, are ſent from Britain to aſſiſt at the council of Arles.
315 Crucifixion aboliſhed.
321 Obſervation of Sunday enjoined.
323 The firſt general council at Nice, when 318 fathers attended, againſt Arius, the founder of Arianiſm, where was compoſed the famous Nicene Creed, which we attribute to them.
328 Conſtantine removes the ſeat of empire from Rome to Byzantium, which is thereafter called Conſtantinople.
330 A dreadful perſecution of the Chriſtians in Perſia, which laſts 40 years.
331 Conſtantine orders all the heathen temples to be deſtroyed.
334 300,000 Sarmatians revolted from their maſters.
341 The goſpel propagated in Ethiopia by Fomentius.
344 Neocæſarea ruined by an earthquake.
351 The heathens firſt called Pagans.
358 An hundred and fifty cities in Aſia and Greece overturned by an earthquake.
360 The firſt monaſtery founded near Poictiers in France, by Martin.
363 The Roman emperor Julian, ſurnamed the Apoſtate, endeavours in vain to rebuild the temple of Jeruſalem.
364 The Roman empire is divided into the eaſtern (Conſtantinople the capital) and weſtern (of which Rome continued to be the capital), each being now under the government of different emperors.
373 The Bible tranſlated into the Gothic language.
376 The Goths ſettled in Thrace.
379 The cycle of Theophilus commenced.
390 A fiery column ſeen in the air for 30 days.
400 Bells invented by biſhop Paulinus, of Campagnia.
401 Europe over-run by the Goths under Alaric.
404 Another irruption of the Goths.
The kingdom of Caledonia or Scotland revives under Fergus.
406 Third irruption of the Goths.
The Vandals, Alans, and Suevi, ſpread into France and Spain, by a conceſſion of Honorius, emperor of the Weſt.
408 The Chriſtian religion propagated in Perſia.
409 Rome taken and plundered by the Goths, Auguſt 24th.
412 The Vandals begin their kingdom in Spain.
413 The kingdom of Burgundy begun in Alſace.
414 The kingdom of Thoulouſe founded by the Viſigoths.
417 The Alans extirpated by the Goths.
419 Many cities in Paleſtine deſtroyed by an earthquake.
420 The kingdom of France begins upon the Lower Rhine, under Pharamond.
421 The Salique law promulgated.
426 The Romans, reduced to extremities at home, withdraw their troops from Britain, and never return; adviſing the Britons to arm in their own defence, and truſt to their own valour.
432 The goſpel preached in Ireland by St Patrick.
444 All Europe ravaged by the Huns.
446 The Britons now left to themſelves, are greatly haraſſed by the Scots and Picts, upon which they once more make their complaint to the Romans (which they intitle, *The Groans of the Britons*), but receive no aſſiſtance from that quarter.
447 Attila (ſurnamed the Scourge of God) with his Huns ravage the Roman empire.
449 Vortigern, king of the Britons, invites the Saxons into Britain, againſt the Scots and Picts.

452 The city of Venice founded.

455 The Saxons having repulſed the Scots and Picts, invite over more of their countrymen, and begin to eſtabliſh themſelves in Kent, under Hengiſt.

476 The weſtern empire is finiſhed, 523 years after the battle of Pharſalia; upon the ruins of which ſeveral new ſtates ariſe in Italy and other parts, conſiſting of Goths, Vandals, Huns, and other barbarians, under whom literature is extinguiſhed, and the works of the learned are deſtroyed.

480 A great earthquake at Conſtantinople, which laſted 40 days.

493 Italy reduced by Theodoric king of the Goths.

496 Clovis, king of France, baptized, and Chriſtianity begins in that kingdom.

506 The Jewiſh talmud publiſhed

508 Prince Arthur begins his reign over the Britons.

510 Paris made the capital of the French dominions.

515 Conſtantinople beſieged by Vitalianus, whoſe fleet is burnt by a ſpeculum of braſs made by Proclus.

516 The computing of time by the Chriſtian era is introduced by Dionyſius the monk.

517 Five years drought and famine in Paleſtine.

519 A bearded comit appears.

529 The codex of Juſtinian, the eaſtern emperor, is publiſhed.

534 The kingdom of the Vandals in Africa comes to an end, after having continued 105 years.

536 The manufacture of ſilk introduced at Conſtantinople by two Indian monks.

540 Antioch deſtroyed by the Perſians.

541 Baſilius the laſt conſul elected at Rome.

542 Antioch rebuilt.

543 An earthquake all over the world.

550 An earthquake in Paleſtine and Syria.

The kingdom of Poland founded.

551 An earthquake in Greece, attended with a great commotion in the ſea.

553 The empire of the Goths in Italy deſtroyed by Narſes.

A great earthquake at Conſtantinople.

557 Another violent earthquake at Conſtantinople, Rome, &c.

A terrible plague all over Europe, Aſia, and Africa, which continues near fifty years.

568 The Lombards founded a kingdom in Italy.

569 The Turks firſt mentioned in hiſtory.

The exarchate of Ravenna begins.

575 The firſt monarchy founded in Bavaria.

580 Antioch deſtroyed by an earthquake.

581 Latin ceaſed to be ſpoken about this time in Italy.

584 The origin of fiefs in France.

588 The city of Paris deſtroyed by fire.

589 Rome overflowed by the Tiber.

593 The Gaſcons eſtabliſhed themſelves in the country called by their name.

596 John of Conſtantinople aſſumes the title of univerſal biſhop.

597 Auguſtin the monk comes into England with forty monks.

599 A dreadful peſtilence in Africa.

604 St Paul's church in London founded.

605 The uſe of bells introduced into churches.

606 Here begins the power of the popes, by the conceſſions of Phocas, emperor of the Eaſt.

622 Mahomet, the falſe prophet, flies from Mecca to Medina, in Arabia, in the 44th year of his age, and 10th of his miniſtry, when he laid the foundation of the Saracen empire, and from whom the Mahometan princes to this day claim their deſcent. His followers compute their time from this era, which in Arabic is called *hegira*, i. e. "the Flight."

628 An academy founded at Canterbury.

632 The era of Jeſdegird commenced June 16th.

637 Jeruſalem is taken by the Saracens or followers of Mahomet.

641 Alexandria in Egypt is taken by ditto, and the grand library there burnt by order of Omar their caliph or prince.

643 The temple of Jeruſalem converted into a Mahometan moſque.

653 The Saracens now extend their conqueſts on every ſide, and retaliate the barbarities of the Goths and Vandals upon their poſterity.

They take Rhodes, and deſtroy the famous Coloſſus.

England invaded by the Danes.

660 Organs firſt uſed in churches.

663 Glaſs invented by a biſhop, and brought into England by a Benedictine monk.

669 Sicily invaded, and Syracuſe deſtroyed by the Saracens.

685 The Britons, after a brave ſtruggle of near 150 years, are totally expelled by the Saxons, and driven into Wales and Cornwall.

698 The Saracens take Carthage, and expel the Romans from Africa.

700 Cracow built, and the firſt prince of Poland elected.

704 The firſt province given to the Pope.

713 The Saracens conquer Spain.

714 France governed by Charles Martel.

718 The kindom of the Aſturias in Spain founded by Pelagio.

719 Chriſtianity promulgated in Germany.

726 The controverſy about images begins, and occaſions many inſurrections in the eaſtern empire.

727 Tax of Peter's pence begun by Ina king of Weſſex.

732 Charles Martel defeats the Saracens near Tours.

735 Inſtitution of the office of Pope's Nuncio.

746 Three years peſtilence in Europe and Aſia.

748 The computing of years from the birth of Chriſt began to be uſed in hiſtory.

749 The race of Abbas become caliphs of the Saracens, and encourage learning.

The empire of the Saracens divided into three.

752 The exarchate of Ravenna aboliſhed by Aſtolphus king of the Lombards.

755 Commencement of the Pope's temporal dominion.

762 The city of Bagdad upon the Tigris, is made the capital for the caliphs of the houſe of Abbas.

763

762 Burials, which formerly uſed to be in highways, permitted in towns.
792 An academy founded in Paris.
794 The Huns extirpated by Charlemagne.
797 Seventeen days of unuſual darkneſs.
800 Charlemagne, king of France, begins the empire of Germany, afterwards called the weſtern empire; gives the preſent names to the winds and months; endeavours to reſtore learning in Europe, but mankind are not yet diſpoſed for it, being ſolely engroſſed in military enterpriſes.
801 A great earthquake in France, Germany, and Italy.
807 Jan. 31. Jupiter eclipſed by the moon. March 17. A large ſpot ſeen on the ſun for eight days.
808 The firſt deſcent of the Normans on France.
825 The obliquity of the ecliptic obſerved by Benimula to be 23° 55′.
826 Harold, king of Denmark, dethroned by his ſubjects for being a Chriſtian.
The kingdoms of Navarre and Arragon founded.
832 Painters baniſhed out of the eaſtern empire.
836 The Flemings trade to Scotland for fiſh.
840 The Scots and Picts have a deciſive battle, in which the former prevail, and both kingdoms are united by Kenneth, which begins the ſecond period of the Scottiſh hiſtory.
842 Germany ſeparated from the empire of the Franks.
856 An earthquake over the greateſt part of the known world.
861 Ruric the firſt prince of Ruſſia began to reign.
864 The Danes begin their ravages in England.
867 Chriſtianity propagated in Bulgaria.
868 Egypt becomes independent on the caliphs of Bagdad.
872 Bells and clocks firſt uſed in Conſtantinople.
873 France diſtreſſed by locuſts and peſtilence.
874 Iceland peopled by the Norwegians.
Scotland invaded by the Danes.
875 A bearded comet appears in France.
878 Alfred the Great, after ſubduing the Daniſh invaders (againſt whom he fought 56 battles by ſea and land), compoſes his body of laws; divides England into counties, hundreds, tythings; in 890 erects county-courts, having founded the univerſity of Oxford in 886.
880 The obliquity of the ecliptic obſerved by Albategni to be 23° 35′.
886 The Hungarians ſettled near the Danube.
891 The firſt land-tax in England.
895 The monaſtery of Cluny founded.
905 A very remarkable comet appeared in China.
Rome taken by the Normans.
911. The obliquity of the ecliptic obſerved by Thebit to be 23° 33′ 30″.
912 The Normans eſtabliſh themſelves in Normandy.
913 The Danes become maſters of England.
915 The univerſity of Cambridge founded.
923 Fiefs eſtabliſhed in France.
925 Sigefroi elected firſt marquis of Brandenburgh.
928 The marquiſate of Miſnia eſtabliſhed.
937 The Saracen empire is divided by uſurpation into ſeven kingdoms.
941 Arithmetic brought into Europe.
961 Candia recovered from the Saracens.
967 Antioch recovered from the Saracens.
969 The race of Abbas extinguiſhed in Egypt.
975 Pope Boniface VII. is depoſed and baniſhed for his crimes.
977 Greece, Macedon, and Thrace, ravaged by the Bulgarians for ten years.
The Bohemians ſubdued by Otho.
979 Coronation oath firſt uſed in England.
Juries firſt inſtituted into ditto.
985 The danes under Sueno invaded England and Scotland.
987 The Carlovingian race in France ended.
991 The figures in arithmetic are brought into Europe by the Saracens from Arabia; letters of the alphabet were hitherto uſed.
993 A great eruption of Mount Veſuvius.
995 England invaded by the Danes and Norwegians.
996 Otho III. makes the empire of Germany elective.
999 Boleſlaus, the firſt king of Poland.
The obliquity of the ecliptic obſerved by Aboul-Waſi and Abu Hamed to be 23° 35′.
1000 Paper made of cotton rags was in uſe; that linen rags in 1170: the manufactory introduced into England at Deptford, 1588.
1002 The emperor Henry aſſumed the title of king of the Romans.
1005 All the old churches are rebuilt about this time in a new manner of architecture.
1006 A plague in Europe for three years.
1007 A great eruption of Veſuvius.
The obliquity of the ecliptic obſerved by Albatrunius to be 23° 35′.
1014 Sueno the Dane becomes maſter of England.
Sept. 28. Almoſt all Flanders laid under water by a ſtorm.
1015 Children forbidden by law to be ſold by their parents in England.
1017 Rain of the colour of blood for three days in Aquitain.
1022 A new ſpecies of muſic invented by Aretin.
1035 Togrul-Beg, or Tangrolipix, the Turkiſh ſultan, eſtabliſhes himſelf in Koraſan.
The kingdoms of Caſtile and Arragon began.
1040 The Danes, after ſeveral engagements with various ſucceſs, are about this time driven out of Scotland, and never again return in a hoſtile manner.
Smyrna deſtroyed by an earthquake.
1041 The Saxon line reſtored under Edward the Confeſſor.
1043 The Turks become formidable and take poſſeſſion of Perſia.
The Ruſſians come from Scythia, and land in Thrace.
1054 Leo IX, the firſt pope that kept up an army.
1055 The Turks take Bagdad, and overturn the empire of the Saracens.
1057 Malcolm III, king of Scotland, kills the tyrant Macbeth at Dunſinnan, and marries the princeſs Margaret, ſiſter to Edgar Atheling.

1061 Surnames appointed to be taken in Scotland by a parliament held in Forfar.

1065 The Turks take Jeruſalem from the Saracens.

1066 The conqueſt of England by William (ſurnamed the Baſtard) duke of Normandy, in the battle of Haſtings, where Harold is ſlain.

1070 The feudal law introduced into England.

1075 Henry IV. emperor of Germany, and the pope, quarrel about the nomination of the German biſhops. Henry, in penance, walks barefooted to the pope towards the end of January.

1076 Juſtices of the peace firſt appointed in England.

An earthquake in England.

Aſia Minor, having been two years under the power of Solyman, is from this time called Turky.

1080 Doomſday-book began to be compiled by order of William, from a ſurvey of all the eſtates in England, and finiſhed in 1086.

The Tower of London built by ditto, to curb his Engliſh ſubjects; numbers of whom fly to Scotland, where they introduce the Saxon or Engliſh language, are protected by Malcolm, and have lands given them.

1086 The order of Carthuſians eſtabliſhed by Bruno.

1090 The dynaſty of Bathineens or Aſſaſſins begins in Irak, and continues for 117 years.

1091 The Saracens in Spain, being hard preſſed by the Spaniards, call to their aſſiſtance Joſeph king of Morocco; by which the Moors get poſſeſſion of all the Saracen dominions in Spain.

1096 The firſt cruſade to the Holy Land is begun under ſeveral Chriſtian princes, to drive the infidels from Jeruſalem.

1098 The order of St Benedict inſtituted.

1099 Jeruſalem taken by the cruſaders; Godfrey elected king of it; and the order of knights of St John inſtituted.

1110 Edgar Atheling, the laſt of the Saxon princes, dies in England, where he had been permitted to reſide as a ſubject.

Learning revived at Cambridge.

Writing on paper made of cotton common about this time.

1118 The order of the knights Templars inſtituted, to defend the Sepulchre at Jeruſalem, and to protect Chriſtian ſtrangers.

1119 Bohemia erected into a kingdom.

1132 The kingdom of Portugal began.

1137 The pandect of Juſtinian found in the ruins of Amalphi.

1141 The factions of the Guelphs and Gibellines prevailed about this time.

1143 The Koran tranſlated into Latin.

1144 The Peripatetic philoſophy introduced into Germany.

1151 The canon law collected by Gratian, a monk of Bologna.

1154 Chriſtianity introduced into Finland.

1156 The city of Moſcow in Ruſſia founded.

1160 The order of the Carmelites inſtituted.

1163 London bridge, conſiſting of 19 ſmall arches, firſt built of ſtone.

1164 The teutonic order of religious knights begins in Germany.

1171 The dynaſty of Fatemites ended in Egypt; the ſovereigns of this country henceforth called Sultans.

1172 Henry II. king of England (and firſt of the Plantagenets), takes poſſeſſion of Ireland; which, from that period, has been governed by an Engliſh viceroy, or lord lieutenant.

1176 England is divided by Henry into ſix circuits, and juſtice is diſpenſed by itinerant judges.

1179 The univerſity of Padua founded.

1180 Glaſs windows began to be uſed in private houſes in England.

1181 The laws of England are digeſted about this time by Glanville.

1182 Pope Alexander III. compelled the kings of England and France to hold the ſtirrups of his ſaddle when he mounted his horſe.

1183 7000 Albigenſes maſſacred by the inhabitants of Berry.

1186 A conjunction of all the planets at ſunriſe September 16. The Sun in 30° ♍; Jupiter in 2° 3′ ♎; Venus in 3° 49′; Saturn in 8° 6′; Mercury in 4° 10′; Mars, 9° 8′; tail of the Dragon, 18° 23′ ♎.

1187 Jeruſalem taken by Saladin.

1192 The battle of Aſcalon, in Judea, in which Richard, king of England, defeates Saladin's army, conſiſting of 300,000 combatants.

1194 *Dieu et mon Droit*, firſt uſed as a motto by Richard, on a victory over the French.

1195 Denmark and Norway laid waſte by a dreadful tempeſt.

1198 Inſtitution of the order of the Holy Trinity.

1200 Chimnies were not known in England.

Surnames now began to be uſed; firſt among the nobility.

Univerſity of Salamanca in Spain founded.

1204 Conſtantinople taken by the French and Venetians.

The Inquiſition eſtabliſhed.

The empire of Trebizond eſtabliſhed.

1208 London incorporated, and obtained their firſt charter for electing their Lord Mayor and other magiſtrates from king John.

The order of *Fratres Minores* eſtabliſhed.

The pope excommunicates king John.

1209 The works of Ariſtotle imported from Conſtantinople into Europe.

The ſilk manufacture imported from Greece into Venice.

1210 The works of Ariſtotle condemned to be burnt at Paris.

The emperor Otho excommunicated by the pope.

Violent perſecution of the Albigenſes.

1215 Magna Charta is ſigned by king John and the barons of England.

Court of common pleas eſtabliſhed.

Orders of the Dominicans and Knights Hoſpitallers founded.

The doctrine of tranſubſtantiation introduced.

1216 King Alexander and the whole kingdom of

Scotland excommunicated by the pope's legate.

1220 Aſtronomy and geography brought into Europe by the Moors.

1222 A great earthquake in Germany.

1223 A comet of extraordinary magnitude appeared in Denmark.

1226 A league formed againſt the Albigenſes by the French king and many prelates and lords.

1227 The Tartars, under Gingis-Kan, emerge from the northern parts of Aſia, over-run all the Saracen empire, and carry death and deſolation wherever they march.

1228 The univerſity of Thoulouſe founded.

1230 The kingdom of Denmark diſtreſſed by peſtilence.

The kingdoms of Leon and Caſtile united.

Pruſſia ſubdued by the Teutonic knights.

Univerſity of Naples founded.

1231 The Almageſt of Ptolemy tranſlated into Latin.

1233 The Inquiſition, begun in 1204, is now truſted to the Dominicans.

The houſes of London, and other cities in England, France, and Germany, ſtill thatched with ſtraw.

1238 The univerſity of Vienna founded.

1239 A writing of this year's date on paper made of rags ſtill extant.

1241 The Hanſeatic league formed.

Tin mines diſcovered in Germany.

1245 A clear red ſtar, like Mars, appears in Capricorn.

1250 Painting revived in Florence by Cimabue.

1251 Wales ſubdued, and Magna Charta confirmed.

1253 The famous aſtronomical tables are compoſed by Alonſo king of Caſtile.

1256 The order of the Auguſtines eſtabliſhed.

1258 The Tartars take Bagdad, which finiſhes the empire of the Saracens.

1260 The ſect of Flagellantes appeared in Italy.

1263 Acho king of Norway invades Scotland with 160 ſail, and lands 20,000 men at the mouth of the Clyde; but they are cut to pieces by Alexander III. who recovers the weſtern iſles.

1264 The commons of England firſt ſummoned to parliament about this time.

1268 The Tartars invade China.

1269 The Hamburgh company incorporated in England.

The obliquity of the ecliptic obſerved by Cozah Naſirodni to be 23° 30'.

1272 The academy of Florence founded.

1273 The empire of the preſent Auſtrian family begins in Germany.

The obliquity of the ecliptic obſerved by Cheou-king in China to be 23° 33' 39''.

1274 The firſt commercial treaty betwixt England and Flanders.

1279 King Edward renounced his right to Normandy.

The mortmain act paſſed in England.

1282 Lewellyn, prince of Wales, defeated and killed by Edward I. who unites that principality to England.

A great peſtilence in Denmark.

8000 French murdered at the Sicilian veſpers.

Academy de la Cruſca founded.

1284 Edward II. born at Caernarvon, is the firſt prince of Wales.

1285 Alexander III. king of Scotland, dies, and that kingdom is diſputed by twelve candidates, who ſubmit their claims to the arbitration of Edward king of England; which lays the foundation of a long and deſolating war between both nations.

1290 The univerſity of Liſbon founded.

1291 Ptolemais taken by the Turks. End of the cruſades.

1293 There is a regular ſucceſſion of Engliſh parliaments from this year, being the 22d of Edward I.

1294 Parliaments eſtabliſhed in Paris.

1298 The preſent Turkiſh empire begins in Bithynia under Ottoman.

Silver-hafted knives, ſpoons, and cups, a great luxury.

Tallow candles ſo great a luxury, that ſplinters of wood were uſed for lights.

Wine ſold by apothecaries as a cordial.

The Scots defeated by the Engliſh at Falkirk.

1299 An earthquake in Germany.

Spectacles invented by a monk of Piſa.

The year of jubilee inſtituted by Boniface VIII.

1302 The mariner's compaſs invented, or improved, by Giovia, of Naples.

The univerſity of Avignon founded.

1307 The beginning of the Swiſs cantons.

Coal firſt uſed in England.

1308 The popes remove to Avignon in France for 70 years.

1310 Lincoln's inn ſociety eſtabliſhed.

The knights of St John take poſſeſſion of the iſle of Rhodes.

1314 The battle of Bannockburn, between Edward II. and Robert Bruce, which eſtabliſhes the latter on the throne of Scotland.

The cardinals ſet fire to the conclave and ſeparate, A vacancy in the papal chair for two years.

1315 Germany afflicted with famine and peſtilence.

1319 The univerſity of Dublin founded.

1320 Gold firſt coined in Chriſtendom; 1344 ditto in England.

An earthquake in England.

1323 A great eruption of Mount Ætna.

1325 The firſt treaty of commerce betwixt England and Venice.

1330 Gunpowder invented by a monk of Cologne.

1332 The pope accuſed of hereſy.

1336 Two Brabant weavers ſettle at York, which, ſays Edward III. may prove of great benefit to us and our ſubjects.

1337 The firſt comet whoſe courſe is deſcribed with an aſtronomical exactneſs.

Europe infeſted by locuſts.

1340 Heralds college inſtituted in England.

Copper-money firſt uſed in Scotland and Ireland.

1344 The firſt creation to titles by patents uſed by Edward III.

1345 Edward III. has four pieces of cannon, which gained him the battle of Creſſy.

1347 The battle of Durham, in which David, king of Scots, is taken, priſoner.

1349 The order of the Garter inſtituted in England by Edward III. altered in 1557, and conſiſts of 26 knights.
1352 The Turks firſt enter Europe.
1353 Aſia and Africa deſolated by locuſts.
1354 The money in Scotland till now the ſame as in England.
1356 The battle of Poictiers, in which king John of France and his ſon are taken priſoners by Edward the Black Prince.
1357 Coals firſt brought to London.
1358 Arms of England and France firſt quartered by Edward III.
University of Cologne founded.
Tamerlane began to reign in Perſia.
1362 The law pleadings in England changed from French to Engliſh as a favour of Edward III. to his people.
The military order of Janizaries eſtabliſhed among the Turks.
1365 The univerſities of Vienna and Geneva founded
1369 John Wickliffe an Engliſhman begins to call in queſtion the doctrines of the church of Rome about this time, whoſe followers are called Lollards.
1370 The office of Grand vizir eſtabliſhed.
1377 Inundation of the ſea in Flanders.
1378 Greenland diſcovered by a Venetian.
1381 Bills of Exchange firſt uſed in England.
1384 The firſt act of navigation in England; no goods to be exported or imported by Engliſhmen in foreign bottoms.
1386 A company of linen weavers from the Netherlands eſtabliſhed in London.
Windſor caſtle built by Edward III.
1387 The firſt Lord High Admiral of England inſtituted.
1388 The battle of Otterburn between Hotſpur and the earl of Douglas.
Bombs invented at Venloo.
1391 Cards invented in France for the king's amuſement.
1399 Weſtminſter abbey rebuilt and enlarged—Weſtminſter hall ditto.
Order of the bath inſtituted at the coronation of Henry IV. renewed in 1725; conſiſting of 38 knights.
1402 Tamerlane defeats and takes priſoner Bajazet the Turkiſh ſultan.
1405 The Canary iſlands diſcovered by Bathencourt a Norman.
1410 Guildhall, London, built.
Painting in oil-colours invented at Bruges by John Van-eyck.
1411 The univerſity of St Andrew's in Scotland founded.
1412 Algebra brought from Arabia into Europe.
1415 The battle of Agincourt gained over the French by Henry V. of England.
1420 The iſland of Madeira diſcovered by the Portugueſe.
1421 The revenue of England amounted to L. 55,754.
1428 The ſiege of Orleans, the firſt blow to the Engliſh power in France.
1431 A great earthquake at Liſbon.
1432 Great inundations in Germany.
1437 The obliquity of the ecliptic obſerved by Ulug Beg to be 23° 30′ 17″.
1440 Printing invented by L. Koſter at Haerlem in Holland; brought into England by W. Caxton, a mercer of London, 1471.
1446 The Vatican library founded at Rome.
The ſea breaks in at Dort in Holland, and drowns 100,000 people.
1453 Conſtantinople taken by the Turks, which ends the eaſtern empire, 1123 years from its dedication by Conſtantine the great, and 2206 years from the foundation of Rome.
1454 The univerſity of Glaſgow in Scotland founded.
1457 Glaſs firſt manufactured in England.
1460 Engraving and etching on copper invented.
The obliquity of the ecliptic obſerved by Purbachius and Regiomontanus to be 23° 29′.
1473 The ſtudy of the Greek language introduced into France.
1477 The univerſity of Aberdeen in Scotland founded.
1479 Union of the kingdoms of Arragon and Caſtile.
1482 The coaſt of Guinea diſcovered by the Portugueſe.
A court of Inquiſition erected in Seville.
1485 Richard III. king of England and laſt of the Plantagenets, is defeated and killed at the battle of Boſworth, by Henry (Tudor) VII. which puts an end to the civil wars between the houſes of York and Lancaſter, after a conteſt of 30 years, and the loſs of 100,000 men.
1486 Henry eſtabliſhes fifty yeomen of the guards, the firſt ſtanding army.
1489 Maps and ſea charts firſt brought to England by Barth. Columbus.
1490 William Grocyn introduces the ſtudy of the Greek language into England.
The Moors, hitherto a formidable enemy to the native Spaniards, are entirely ſubdued by Ferdinand, and become ſubjects to that prince on certain conditions, which are ill obſerved by the Spaniards, whoſe clergy uſe the Inquiſition in all its tortures; and in 1609, near one million of the Moors are driven from Spain to the oppoſite coaſt of Africa, from whence they originally came.
1492 America firſt diſcovered by Columbus, a Genoeſe in the ſervice of Spain.
The Moors expelled from Granada, which they had poſſeſſed upwards of 800 years.
1495 The venereal diſeaſe introduced into Europe.
1496 The Jews and Moors baniſhed out of Portugal.
1497 The Portugueſe firſt ſail to the Eaſt Indies by the Cape of Good Hope.
South America diſcovered by Americus Veſpuſius, from whom it has its name.
1499 North America diſcovered, for Henry VII. by Cabot a Venetian.
1500 Maximilian divides the empire of Germany into ſix circles, and adds four more in 1512.
Brazil diſcovered by the Portugueſe. Florida diſcovered by John Cabot, an Engliſhman.
Painting in chiaro obſcuro diſcovered.
A great plague in England.
1505 Shillings firſt coined in England.

1507 The iſland of Madagaſcar diſcovered by the Portugueſe.

1509 Gardening introduced into England from the Netherlands, from whence vegetables were imported hitherto.

1510 The obliquity of the ecliptic obſerved by Wernerus to be 23° 28′ 30″.

1513 The battle of Flowden, in which James IV. king of Scotland is killed, with the flower of his nobility.

1514 Cannon bullets of ſtone ſtill in uſe.

1515 The firſt Polyglot Bible printed at Alcala.

The kingdom of Navarre annexed to that of Caſtile by Ferdinand.

1516 The kingdom of Algiers ſeized by Barbaroſſa.

1517 Martin Luther began the Reformation.

Egypt is conquered by the Turks.

The kingdom of the Mamalukes in Egypt overthrown by the Turks.

1518 Diſcovery of New Spain, and the Straits of Magellan.

1521 Henry VII. for his writings in favour of popery, receives the title of Defender of the Faith from his Holineſs.

1522 Rhodes taken by the Turks.

The firſt voyage round the world performed by a ſhip of Magellan's ſquadron.

1526 The inquiſition eſtabliſhed in Portugal.

Lutheraniſm eſtabliſhed in Germany.

1527 Rome taken and plundered by the Imperial army.

1528 Popery aboliſhed in Sweden.

1529 The name of Proteſtant takes its riſe from the reformed proteſting againſt the church of Rome, at the diet of Spires in Germany.

1530 Union of the Proteſtants at Smallcalde, December 22d.

Secretary of State's office eſtabliſhed in England.

1531 A great earthquake at Liſbon.

1532 The Court of Seſſion inſtituted in Scotland.

1533 Inſurrection of the Anabaptiſts in Weſtphalia.

1534 The reformation takes place in England, under Henry VIII.

Barbaroſſa ſeized on the kingdom of Tunis.

1535 The Reformation introduced into Ireland.

The ſociety of Jeſuits formed.

1539 The firſt Engliſh edition of the Bible authoriſed; the preſent tranſlation finiſhed 1611.

About this time cannon began to be uſed in ſhips.

Six hundred and forty-five religious houſes ſuppreſſed in England and Wales.

1540 The variation of the compaſs diſcovered by Sebaſtian Cabot.

The obliquity of the ecliptic obſerved by Copernicus to be 23° 28′ 8″.

Society of the Jeſuits eſtabliſhed, September 27.

1543 Silk ſtockings firſt worn by the French king; firſt worn in England by queen Eliz. 1561; the ſteel frame for weaving invented by the Rev. Mr Lee, of St John's College, Cambridge, 1589.

Pins firſt uſed in England, before which time the ladies uſed ſkewers.

Iron cannon and mortars made in England.

1544 Good lands let in England at one ſhilling per acre.

1545 The famous council of Trent begins, and continues 18 years.

1547 Firſt law in England eſtabliſhing the intereſt of money at 10 *per cent.*

1548 The Reformation gained ground in Poland.

1549 Lords lieutenants of counties inſtituted in England.

1550 Horſe guards inſtituted in England.

The bank of Venice eſtabliſhed about this time.

1552 Books of geography and aſtronomy deſtroyed in England, as being infected with magic.

The book of Common Prayer eſtabliſhed in England by act of Parliament.

1554 The kingdom of Aſtracan conquered by the Ruſſians.

1555 The Ruſſian company eſtabliſhed in England.

1558 Queen Elizabeth begins her reign.

1560 The reformation in Scotland completed by John Knox.

1561 Livonia ceded to Poland.

1563 Knives firſt made in England.

1565 Revolt of the Low Countries.

Malta attacked by the Turks.

1566 The 39 articles of the church of England eſtabliſhed.

1568 Queen Mary impriſoned in England.

Liberty of exerciſing the reformed religion granted to the Low Countries.

2569 Royal Exchange firſt built.

1571 The iſland of Cyprus taken by the Turks.

They are defeated at Lepanto.

1572 The great maſſacre of Proteſtants at Paris.

A new ſtar in Caſſiopæia obſerved by Cornelius Gemma. It appeared in November, and diſappeared in March.

1576 The exerciſe of the Proteſtant religion authoriſed in France. This toleration followed by a civil war.

1578 The firſt treaty of alliance betwixt England and the States General, January 7th.

1579 The Dutch ſhake off the Spaniſh yoke, and the republic of Holland begins.

Engliſh Eaſt-India company incorporated—eſtabliſhed 1600.

——Turkey company incorporated.

1580 Sir Francis Drake returns from his voyage round the world, being the firſt Engliſh circumnavigator.

Parochial regiſter firſt appointed in England.

The kingdom of Portugal ſeized by Philip of Spain.

1581 Copper money firſt uſed in France.

1582 Pope Gregory introduces the New Stile in Italy; the 5th of October being counted 15.

1583 Tobacco firſt brought from Virginia into England.

The firſt propoſal of ſettling a colony in America.

1587 Mary queen of Scots is beheaded by order of Elizabeth, after 18 years impriſonment.

1588 The Spaniſh Armada deſtroyed by Drake and other Engliſh admirals.

Henry IV. paſſes the edict of Nantes, tolerating the Proteſtants.

1588

1588 Duelling with ſmall ſwords introduced into England.

1589 Coaches firſt introduced into England; hackney act 1693; increaſed to 1000 in 1770.

1590 Band of penſioners inſtituted in England.

Teleſcopes invented by Janſen, a ſpectacle maker in Germany.

1591 Trinity college, Dublin, founded.

1593 A great plague in London.

1594 The Jeſuits expelled from France.

The obliquity of the ecliptic obſerved by Bygius to be 23° 30′.

1595 The ſame obſerved by Tycho-Brache to be 23° 29′ 25″.

1596 A great earthquake at Japan.

1597 Watches firſt brought into England from Germany.

1598 The edict of Nantes by Henry IV. of France.

1602 Decimal arithmetic invented at Bruges.

1603 Queen Elizabeth (the laſt of the Tudors) dies, and nominates James VI. of Scotland as her ſucceſſor; which unites both kingdoms under the name of Great Britain.

1605 The Gun-powder-plot diſcovered at Weſtminſter; being a plot to blow up the king and both houſes of Parliament.

1606 Oaths of allegiance firſt adminiſtered in England.

1608 Colonies ſent from England to Virginia.

1609 The independency of the United States acknowledged by Spain.

1610 Galileo, of Florence, firſt diſcovers the ſatellites about the planet Jupiter, by the teleſcope lately invented in Germany.

Henry IV. is murdered at Paris by Ravaillac a prieſt.

Thermometers invented by Diebel, a Dutchman.

1611 Baronets firſt created in England by James I. May 22.

An earthquake at Conſtantinople; 200,000 perſons died there of the plague.

1612 The north-weſt paſſage to China attempted in vain by the Engliſh.

1614 Napier of Marcheſton, in Scotland, invents the logarithms.

Sir Hugh Middleton brings the new river to London from Ware.

1616 The firſt permanent ſettlement in Virginia.

1619 W. Harvey, an Engliſhman, confirms the doctrine of the circulation of the blood, which had been firſt broached by Servetius, a French phyſician, in 1553.

1620 The broad ſilk manufacture from raw ſilk, introduced into England.

Barbadoes diſcovered by Sir William Courteen.

Navarre united to France.

Copper-money firſt introduced in England.

1621 New England planted by the Puritans.

The two parties of Whigs and Tories formed in England.

1622 The Palatinate reduced by the Imperialiſts.

1623 The knights of Nova Scotia inſtituted.

1624 Maſſacre of the Engliſh at Amboyna.

1625 King James dies, and is ſucceeded by his ſon Charles I.

1625 The iſland of Barbadoes, the firſt Engliſh ſettlement in the Weſt Indies, is planted.

1631 The tranſit of Mercury over the ſun's diſk, firſt obſerved by Gaſſendi.

A great eruption of Veſuvius.

1632 The battle of Lutzen, in which Guſtavus Adolphus, king of Sweden, and head of the Proteſtants in Germany, is killed.

1633 Galileo condemned by the inquiſition at Rome.

Louiſiana diſcovered by the French.

1635 Province of Maryland planted by lord Baltimore.

Regular poſts eſtabliſhed from London to Scotland, Ireland, &c.

1636 A tranſit of Mercury over the Sun's diſk obſerved by Caſſini.

1639 A tranſit of Venus over the ſun's diſk firſt obſerved by Mr Horrox, November 24th. O. S. 3 h 15′ P. M.

1640 King Charles diſobliges his Scottiſh ſubjects: on which their army, under general Leſley, enters England, and takes Newcaſtle, being encouraged by the malecontents in England.

The maſſacre in Ireland, when 40,000 Engliſh Proteſtants were killed.

The independency of Portugal recovered by John duke of Braganza.

1642 King Charles impeaches five refractory members, which begins the civil wars in England.

1643 Exciſe on beer, ale, &c. firſt impoſed by parliament.

Barometers invented by Torricelli.

1648 A new ſtar obſerved in the tale of the Whale by Fabricius.

1649 Charles I. beheaded by Cromwell at Whitehall, January 30, aged 49.

Pendulums firſt applied to clocks by Huygens.

1651 The ſect called *Quakers* appeared in England.

1652 The Dutch colony at the Cape of Good Hope eſtabliſhed.

1654 Cromwell aſſumes the protectorſhip.

The air-pump invented by Otto Guericke of Magdeburg.

1655 The Engliſh, under Admiral Penn, take Jamaica from the Spaniards.

One of Saturn's ſatellites obſerved by Huygens.

1658 Cromwell dies, and is ſucceeded in the protectorſhip by his ſon Richard.

1660 King Charles II. is reſtored by Monk, commander of the army, after an exile of twelve years in France and Holland.

The people of Denmark, being oppreſſed by the nobles, ſurrender their privileges to Frederic III. who becomes abſolute.

1661 The obliquity of the ecliptic obſerved by Hevelius to be 23° 29′ 7″.

1662 The Royal Society eſtabliſhed at London by Charles II.

1663 Carolina planted; 1728, divided into ſeparate governments.

Pruſſia declared independent of Poland.

1664 The New Netherlands in North America conquered from the Swedes and Dutch by the Engliſh.

1665 The plague rages in London, and carries off 63,000 perſons.

The magic lanthorn invented by Kircher.

1666 The great fire of London began Sept. 2. and continued three days, in which were deſtroyed 13,000 houſes and 400 ſtreets.

Tea firſt uſed in England.

1667 The peace of Breda, which confirms to the Engliſh the New Netherlands, now the States of Pennſylvania, New York, and New Jerſey.

1668 ——ditto Aix la Chapelle.

St James's park planted, and made a thoroughfare for public uſe by Charles II.

1669 The iſland of Candia taken by the Turks.

1670 The Engliſh Hudſon's Bay company incorporated.

The obliquity of the ecliptic obſerved by Mengoli to be 23° 28′ 24″.

1672 Louis XIV. over-runs great part of Holland, when the Dutch opened their ſluices, being determined to drown their country, and retire to their ſettlements in the Eaſt Indies.

African company eſtabliſhed.

The obliquity of the ecliptic obſerved by Richer to be 23° 2 ′ 54″.

1677 The micrometer invented by Kircher.

1678 The peace of Nimeguen.

The habeas corpus act paſſed.

A ſtrange darkneſs at noon-day, Jan. 12.

1680 A great comet appeared, and from its nearneſs to our earth alarmed the inhabitants. It continued viſible from Nov. 3. to March 9.

William Penn, a Quaker, receives a charter for planting Pennſylvania.

1683 India ſtock ſold from 360 to 500 *per cent.*

1685 Charles II. dies, aged 55, and is ſucceeded by his brother James II.

The duke of Monmouth, natural ſon to Charles II. raiſes a rebellion, but is defeated at the battle of Sedgmore, and beheaded.

The edict of Nantes is revoked by Louis XIV. and the Proteſtants are greatly diſtreſſed.

1686 The Newtonian philoſophy publiſhed.

1687 The palace of Verſailles, near Paris, finiſhed by Louis XIV.

1688 The Revolution in Great Britain begins Nov. 5. King James abdicates, and retires to France, Dec. 3.

King William and Queen Mary, daughter and ſon-in-law to James, are proclaimed February 16.

Viſcount Dundee ſtands out for James in Scotland, but is killed by general Mackay at the battle of Killycrankie; upon which the Highlanders, wearied with repeated misfortunes, diſperſe.

Smyrna deſtroyed by an earthquake.

1689 The land-tax paſſed in England.

The toleration-act paſſed in ditto.

Several biſhops are deprived for not taking the oaths to William.

William Fuller, who pretended to prove the prince of Wales ſpurious, was voted by the commons to be a notorious cheat, impoſtor, and falſe accuſer.

1689 Epiſcopacy aboliſhed in Scotland.

1690 The battle of the Boyne, gained by William againſt James, in Ireland.

1691 The war in Ireland finiſhed, by ſurrender of Limerick to William.

The obliquity of the ecliptic obſerved by Flamſtead to be 23° 28′ 32″.

1692 The Engliſh and Dutch fleets, commanded by Admiral Ruſſel, defeat the French fleet off La Hogue.

The maſſacre of Glencoe in Scotland, Jan. 31. O. S.

Earthquakes in England and Jamaica, September 8.

Hanover made an electorate of the empire.

1693 Bayonets at the end of loaded muſkets firſt uſed by the French againſt the confederates in the battle of Turin.

Bank of England eſtabliſhed by King William.

The firſt public lottery was drawn this year.

1694 Queen Mary dies at the age of 33, and William reigns alone.

Stamp duties inſtituted in England.

1696 The peace of Ryſwick.

1699 The Scots ſettled a colony at the iſthmus of Darien in America, and called it *Caledonia.*

1700 Charles XII. of Sweden begins his reign.

King James II. dies at St Germains in the 68th year of his age.

1701 Pruſſia erected into a kingdom.

Society for the propagation of the goſpel in foreign parts eſtabliſhed.

1702 King William dies, aged 50, and is ſucceeded by Queen Anne, daughter to James II. who, with the Emperor and States General, renews the war againſt France and Spain.

The French ſent colonies to the Miſſiſippi.

1703 The obliquity of the ecliptic obſerved by Bianchini to be 23° 28′ 25″.

1704 Gibraltar taken from the Spaniards by Admiral Rooke.

The battle of Blenheim won by the Duke of Marlborough and allies againſt the French.

The court of Exchequer inſtituted in England.

1706 The treaty of Union betwixt England and Scotland, ſigned July 22.

The battle of Ramilies won by Marlborough and the allies.

1707 The firſt Britiſh parliament.

The allies defeated at Almanza.

1708 Minorca taken from the Spaniards by General Stanhope.

The battle of Oudenarde won by Marlborough and the allies.

1709 Peter the Great, czar of Moſcovy, defeats Charles XII. at Poltowa, who flies to Turkey.

The battle of Malplaquet won by Marlborough and the allies.

1710 Queen Anne changes the whig miniſtry for others more favourable to the intereſt of her brother the late Pretender.

The cathedral church of St Paul, London, rebuilt by Sir Chriſtopher Wren in 37 years, at one million expence, by a duty on coals.

The Engliſh South-ſea company began.

1712 Duke of Hamilton and Lord Mohun killed in a duel in Hide-Park.

1713 The peace of Utrecht, whereby Newfoundland, Nova Scotia, New Britain, and Hudſon's bay, in North America, were yielded to Great Britain; Gibraltar and Minorca, in Europe, were alſo confirmed to the ſaid crown by this treaty.

1714 Queen Anne dies, at the age of 50, and is ſucceeded by George I.

Intereſt in England reduced to five *per cent.*

1715 Louis XIV. dies, and is ſucceeded by his great-grandſon Louis XV. the late king of France.

The rebellion in Scotland begins in September under the Earl of Mar, in favour of the Pretender. The action of Sheriffmuir, and the ſurrender of Preſton, both in November, when the rebels diſperſe.

The obliquity of the ecliptic obſerved by Louville to be 23° 28′ 24″.

1716 The Pretender married the princeſs Sobieſka, grand-daughter of John Sobieſki, late king of Poland.

An act paſſed for ſeptennial parliaments.

1718 Sardinia erected into a kingdom, and given to the duke of Savoy.

1719 The Miſſiſippi ſcheme at its height in France.

Lombe's ſilk-throwing machine, containing 26,586 wheels, erected at Derby in England: takes up one-eighth of a mile; one water-wheel moves the reſt; and in 24 hours it works 318,504,960 yards of organzine ſilk thread.

1720 The ſouth-ſea ſcheme in England begun April 7, was at its height at the end of June, and quite ſunk about September 29.

A great earthquake in China.

1724 An earthquake in Denmark.

1727 King George dies, in the 68th year of his age, and is ſucceeded by his only ſon, George II.

Inoculation firſt tried on criminals with ſucceſs.

Ruſſia, formerly a dukedom, is now eſtabliſhed as an empire.

The abberration of the fixed ſtars diſcovered and accounted for by Dr Bradley.

1732 Kouli Khan uſurps the Perſian throne, conquers the Mogul empire, and returns with two hundred thirty-one millions Sterling.

Several public-ſpirited gentleman begin the ſettlement of Georgia in North America.

1733 The Jeſuits expelled from Paraguay.

1736 Capt. Porteous having ordered his ſoldiers to fire upon the populace at an execution of a ſmuggler, is himſelf hanged by the mob at Edinburgh.

A tranſit of Mercury obſerved by Caſſini.

1737 A dreadful hurricane at the mouth of the Ganges, Oct. 10.

1738 Weſtminiſter bridge, conſiſting of 15 arches, begun; finiſhed in 1750, at the expence of 389 000 l. defrayed by parliament.

The order of St Januarius eſtabliſhed at Naples.

1739 Letters of marque iſſued out in Britain againſt Spain July 21. and war declared, Oct 23.

The empire of Indoſtan ruined by Kouli Khan.

An intenſe froſt in Britain.

1743 The battle of Dettingen won by the Engliſh and allies in favour of the Queen of Hungary.

1743 A dreadful plague in Sicily.

1744 War declared againſt France.—Commodore Anſon returns from his voyage round the world.

1745 The allies loſe the battle at Fontenoy.

The rebellion breaks out in Scotland, and the Pretender's army defeated by the Duke of Cumberland at Culloden, April 16, 1746.

1746 Britiſh Linen Company erected.

Lima deſtroyed by an earthquake.

1747 Kouli Khan murdered.

1748 The peace of Aix-la-Chapelle, by which a reſtitution of all places taken during the war was to be made on all ſides.

1749 The intereſt on the Britiſh funds reduced to 3 *per cent.*

Britiſh herring-fiſhery incorporated.

The colony of Nova Scotia founded.

1750 Earthquake in England.

1751 Frederic prince of Wales, father to his preſent majeſty, died.

Antiquarian ſociety at London incorporated.

1752 The new ſtile introduced into Great Britain; the 3d of September being counted the 14th.

1753 The Britiſh muſeum erected at Montague-houſe.

Society of arts, manufactures, and commerce, inſtituted in London.

1754 A dreadful eruption of mount Ætna.

A great earthquake at Conſtantinople, Cairo, &c. Sept. 2d.

1755 Quito in Peru deſtroyed by an earthquake, April 28th.

Liſbon deſtroyed by an earthquake, Nov. 1ſt.

1756 146 Engliſhmen are confined in the black hole at Calcutta in the Eaſt Indies by order of the nabob, and 123 found dead next morning.

Marine ſociety eſtabliſhed at London.

The King of Pruſſia commenced hoſtilities in the month of Auguſt in Saxony. Defeats the Auſtrians at Lo.

1757 Damien attempted to aſſaſſinate the French king.

The King of Pruſſia invades Bohemia. Defeats the Auſtrians at Reichenberg, April 21ſt, and at Prague, May 6th. Repulſed by Count Daun at Kolin, June 18th.

The allies defeated by the French at Haſtenbeck, July 26th.

Convention of Cloſter Seven, Sep. 8th.

The king of Pruſſia defeats the French and Auſtrians at Roſbach, Nov. 5. The Pruſſians defeated near Breſlaw, Nov. 22d. The Auſtrians defeated at Liſſa, Dec. 5th.

1758 Senegal taken by the Britiſh, May 1ſt. They take Louiſbourg, July 27th.

The King of Pruſſia defeats the Ruſſians at Zorndorf, Auguſt 25th. Is defeated by Count Daun at Hoch-kirchen, Oct. 14th.

Goree taken by Commodore Keppel, Dec. 29th.

Attempt to aſſaſſinate the King of Portugal, Dec. 3.

1759 General Wolfe is killed in the battle of Quebec, which is gained by the Britiſh.

The French defeated by Prince Ferdinand at Bergen, April 13th.

Guadaloupe taken by the Britiſh, May 1ſt.

King of Pruſſia defeated by the Ruſſians at Cunerſdorf, Aug. 12th.

1759 The French fleet defeated by Admiral Hawke, Nov. 20th.

Balbec and Tripoli deſtroyed by an earthquake, Dec. 5th.

1760 King George II. dies October 25th, in the 77th year of his age, and is ſucceeded by his preſent majeſty, who, on the 22d of September 1761, married the princeſs Charlotte of Mecklenburgh Strelitz.

Blackfriars-bridge, conſiſting of 9 arches, begun; finiſhed 1770, at the expence of 152,840l. to be diſcharged by a toll.

A tranſit of Venus over the ſun June 6th.

Earthquakes in Syria Oct. 13th.

The King of Pruſſia defeats the Auſtrians at Torgau Nov. 3d.

1761 Pondicherry taken by Col. Coote Jan. 15th.

Belleiſle ſurrendered to the Britiſh Feb. 4th.

1762 War declared againſt Spain.

Peter III. emperor of Ruſſia, is depoſed, impriſoned, and murdered.

American philoſophical ſociety eſtabliſhed in Philadelphia.

George Auguſtus Frederic, prince of Wales, born Aug. 12th

Martinico ſurrended to the Britiſh Feb. 4th.

Havannah ſurrendered to ditto Aug. 12th.

Manilla taken by ditto Oct. 6th

1763 The definitive treaty of peace between Great Britain, France, Spain, and Portugal, concluded at Paris February 10th; which confirms to Great Britain the extenſive provinces of Canada, Eaſt and Weſt Florida, and part of Louiſiana, in North America: alſo the iſlands of Granada, St Vincent, Dominica, and Tobago, in the Weſt Indies.

The Jeſuits expelled from France.

1764 The parliament granted 10,000 l. to Mr Harriſon for his diſcovery of the longitude by his time-piece.

Famine and peſtilence in Italy.

An earthquke at Liſbon.

1765 His majeſty's royal charter paſſed for incorporating the ſociety of artiſts.

An act paſſed annexing the ſovereignty of the iſland of Man to the crown of Great Britain.

1766 April 21ſt. a ſpot or macula of the ſun, more than thrice the bigneſs of our earth, paſſed the ſun's centre.

The American ſtamp-act repealed March 18th

A great earthquake at Conſtantinople.

The Jeſuits expelled from Bohemia and Denmark.

1767 The Jeſuits expelled from Spain, Venice, and Genoa, April 2d.

Martinico almoſt deſtroyed by an earthquake.

The proteſtants tolerated in Poland Nov. 2d.

1768 Academy of painting eſtabliſhed in London.

The Turks impriſon the Ruſſian ambaſſador, and declare war againſt that empire.

The Jeſuits expelled from Naples, Malta, and Parma.

1769 Paoli fled from Corſica June 13th. The iſland then reduced by the French.

1770 An earthquake at St Domingo.

1771 Dr Solander and Mr Banks, in his Britannic majeſty's ſhip the Endeavour, Lieut. Cook, return from a voyage round the world, having made ſeveral important diſcoveries in the Southſeas.

An emigration of 500,000 Tourgeuths from the coaſts of the Caſpian Sea to the frontiers of China.

1772 The King of Sweden changes the conſtitution from ariſtocracy to a limited monarchy.

The pretender marries a princeſs of Germany, grand-daughter of Thomas late Earl of Ayleſbury.

The emperor of Germany, Empreſs of Ruſſia, and the King of Pruſſia, ſtrip the King of poland of a great part of his dominions, which they divide among themſelves, in violation of the moſt ſolemn treaties

1773 Captain Phipps is ſent to explore the North Pole; but having made 81 degrees, is in danger of being locked up by the ice, and his attempt to diſcover a paſſage in that quarter proves fruitleſs.

The Engliſh Eaſt India company having, by conqueſt or treaty, acquired the extenſive provinces of Bengal, Orixa, and Bahar, containing 15 millions of inhabitants, great irregularities are committed by their ſervants abroad; upon which government interferes, and ſends out judges &c. for the better adminiſtration of juſtice.

The war between the Ruſſians and the Turks proves diſgraceful to the latter, who loſe the Iſlands in the Archipelago, and by the ſea are every where unſucceſsful.

The ſociety of Jeſuits ſuppreſſed by the Pope's bull Auguſt 25th.

1774 Peace is proclaimed between the Ruſſians and the Turks.

The Britiſh parliament having paſſed an act laying a duty of 3d. *per* pound upon all teas imported into America, the coloniſts, conſidering this as a greivance, deny the right of the Britiſh parliament to tax them.

The American colonies ſend deputies to Philadelphia, who aſſume the title of *The Congreſs of the Thirteen United Provinces.*

1775 The the American war commences. Action at Bunker's Hill June 7th.

The Spaniards land near Algiers and are defeated July 8th.

1776 The congreſs declare the United States of America independent of the crown and parliament of Great Britain, 4th July.

The Americans receive a dreadful defeat at Long-Iſland Auguſt 27th.

1777 Philadelphia taken by the Britiſh Oct. 3d.

General Burgoyne with his army ſurrender to the Americans.

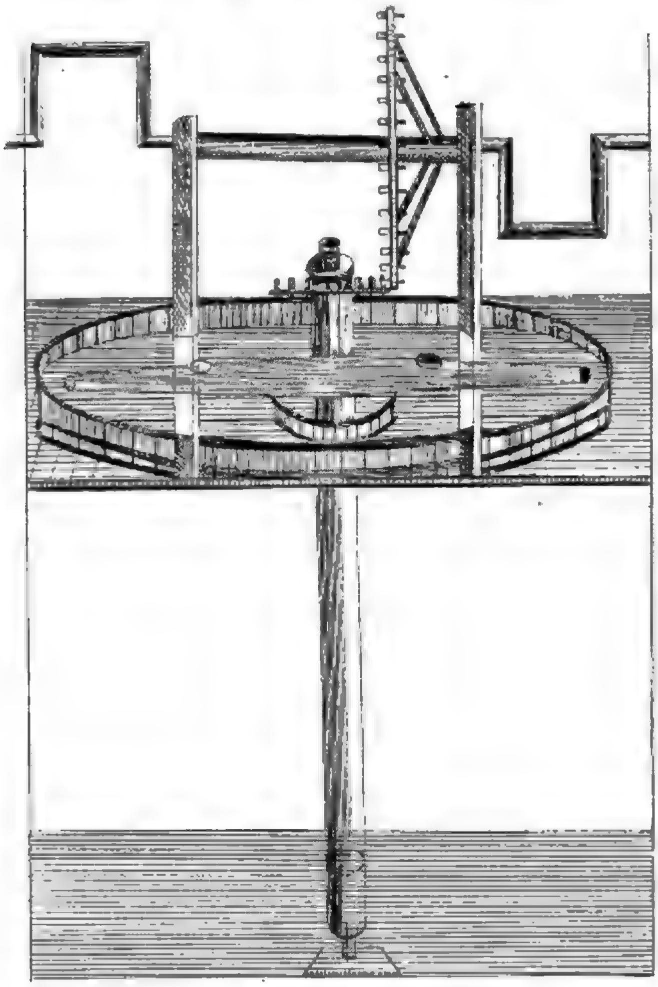
1778 Philadelphia evacuated by the Britiſh, June 18th.

1779 A moſt extraordinary eruption of Veſuvius Auguſt 8th.

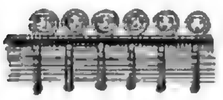
The ſiege of Gibraltar begun by the Spaniards July 8th.

Plate CXXXVI.

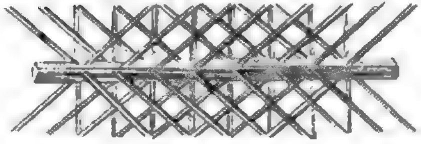
Centrifugal Machine



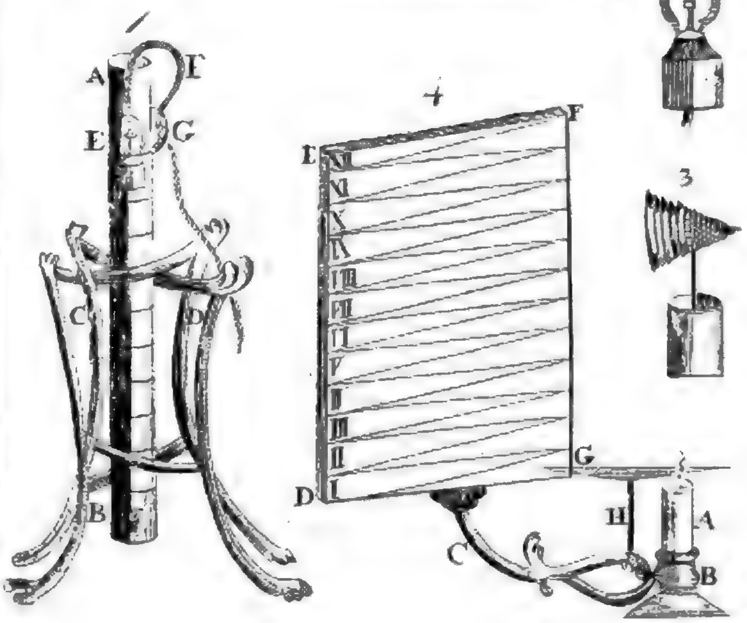
Chain wales.



Cheval-de-Frise.



Chronometer.



Chaff Cutter

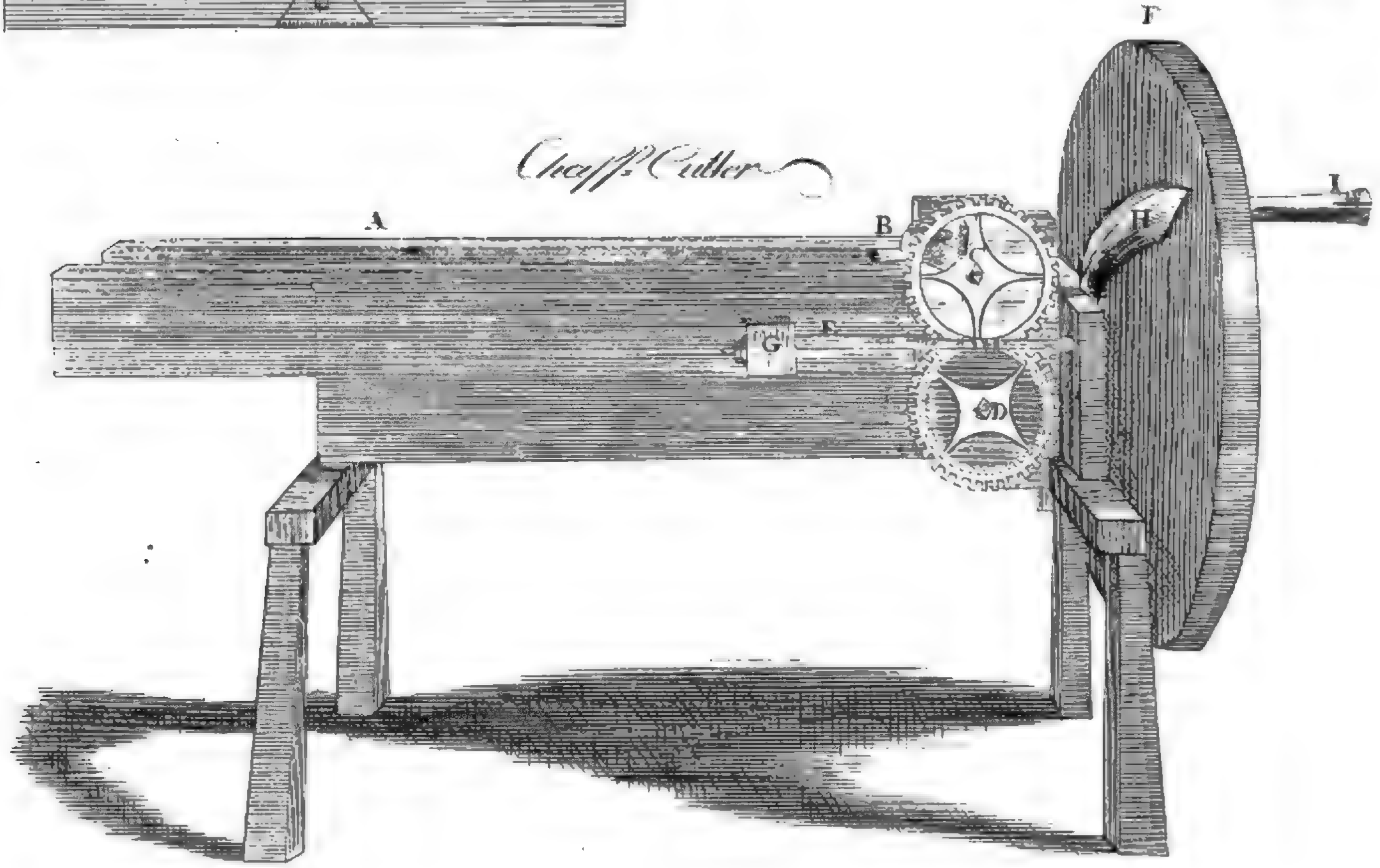


Plate CXXXVII.

CHIMES.

Fig. 1.
The Notes of the 100 Psalm tune

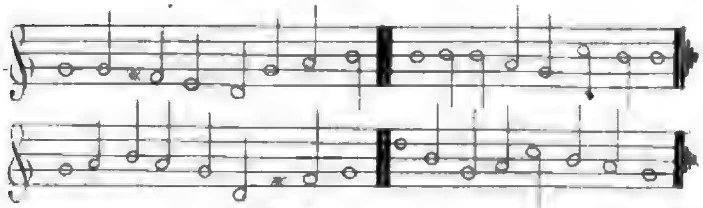
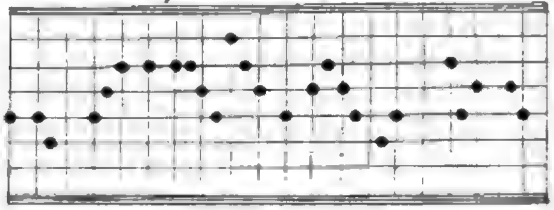


Fig. 2.
A Table for dividing the Chime barrel of the 100 Psalm tune



CIPHER.

Fig. 3.

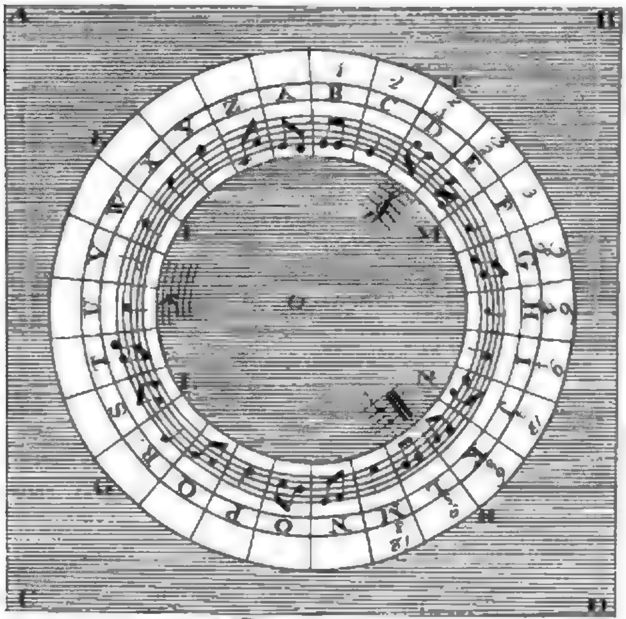


Fig. 4.

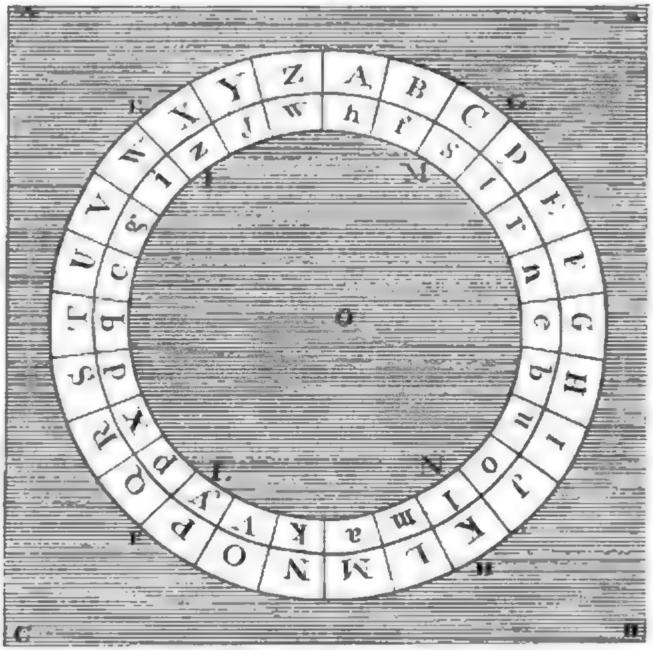

A
B
C
D
E
F
G
H
I
K
L
M
N
O
A B C D E F G H I K L M N O P Q R S T U V W X Y Z
h f s t r n c b u o l m a k y d x p q g c z j w

Fig. 5.

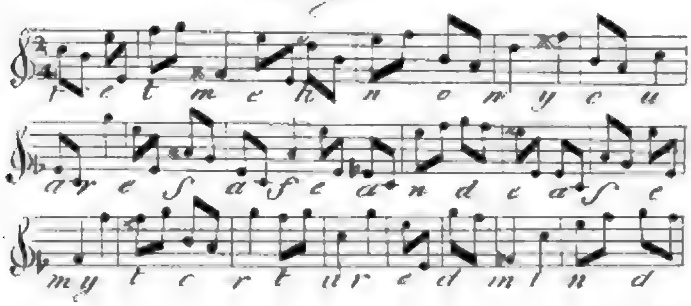


Fig. 6.

Ma un jvc iumin scar
vgxe qv cd jvc dlhmm
lhqr h yrhduck hkt-
jvc ahj dqumm ahlr
h dlhu ryyrduquek

Fig. 7.

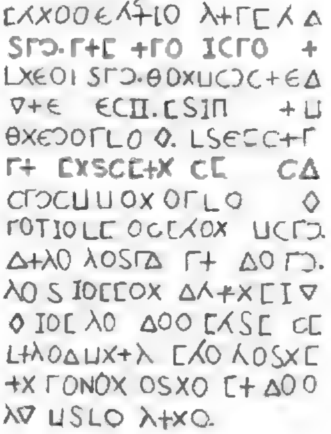


Fig. 8.

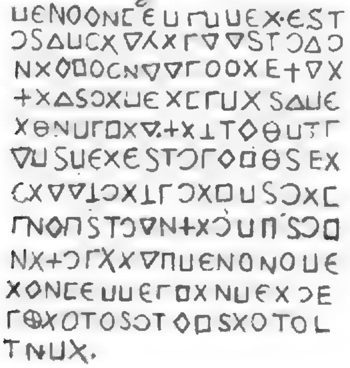
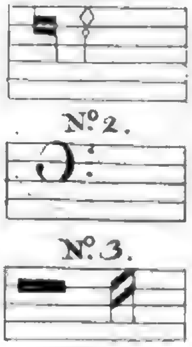


Fig. 9.

CLEFF.



After Chriſt.

1780 Jan. 14th, 6 h. A. M. the thermometer ſuſpended in the open air at Glaſgow, ſtood at 46° below 0.
The Spaniſh fleet defeated by Admiral Rodney Jan. 16th.
Charleſton ſurrendered to the Britiſh May 12th.
A dreadful inſurrection in London, and riots in many other places of the kingdom.
A great number of Britiſh ſhips taken by the combined fleets of France and Spain.
Lord Cornwallis defeats the Americans at Camden.
A dreadful hurricane in the Leeward Iſlands Oct. 9th.
An extraordinary ſtorm of wind in England.
War declared againſt the Dutch Dec. 20th.
1781 A terrible engagement between the Dutch and Britiſh fleets near the Dogger Bank Aug. 5.
Lord Cornwallis with his army ſurrender to the united forces of France and America Oct. 18th.
1782 Minorca ſurrendered to the Spaniards February 4th.
The French fleet under De Graſſe defeated and almoſt deſtroyed by Admiral Rodney April 12th.
The Spaniſh floating batteries before Gibraltar entirely deſtroyed Sept. 12th.
1783 Preliminaries of a general peace ſigned. America declared independent Jan. 20th.
A dreadful earthquake, attended with many extraordinary circumſtances, in Italy and Sicily.
The ſun obſcured by a kind of fog during the whole ſummer.
A volcanic eruption in Iceland ſurpaſſing any thing recorded in hiſtory. The lava ſpouted up in three places to the height of two miles perpendicular, and continued thus for two months; during which time it covered a tract of 3600 ſquare miles of ground, in ſome places more than 100 feet deep.
A large meteor appears to the northward of Shetland, and takes its direction ſouthward, with a velocity little inferior to that of the earth in its annual courſe round the ſun. Its tract obſerved for more than 1000 miles.
1787 General Convention meet at Philadelphia for the purpoſe of forming a new conſtitution, which was afterwards adopted by all the ſtates.
1789 Firſt Congreſs meet under the federal conſtitution March 4th.
States General opened at Paris April 25th.
Baſtile demoliſhed by the people July 14th.
Conſtitution of France framed Auguſt 6th.

Chronometer.

CHRONOMETER, in general, denotes any inſtrument or machine uſed in meaſuring time; ſuch are dials, clocks, watches, *&c.* See DIAL, *&c.*

The term *chronometer*, however, is generally uſed in a more limited ſenſe, for a kind of clock ſo contrived as to meaſure a ſmall portion of time with great exactneſs, even to the ſixteenth part of a ſecond: of ſuch a one there is a deſcription in Deſagulier's experimental philoſophy, invented by the late ingenious Mr George Graham; which muſt be allowed to be of great uſe for meaſuring ſmall portions of time in aſtronomical obſervations, the time of the fall of bodies, the velocity of running waters, *&c.* But long ſpaces of time cannot be meaſured by it with ſufficient exactneſs, unleſs its pendulum be made to vibrate in a cycloid; becauſe, otherwiſe it is liable to err conſiderably, as all clocks are which have ſhort pendulums that ſwing in large arches of a circle.

There have been ſeveral machines contrived for meaſuring time, under the name of *chronometers*, upon principles very different from thoſe on which clocks and watches are conſtructed.

Plate CXXXVI. fig. 1. repreſents an air-chronometer, which is conſtructed in the following manner. Provide a glaſs tube of about an inch in diameter, and three or four feet long: the diameter of the inſide of this tube muſt be preciſely equal in every part: at the bottom muſt be a ſmall hole, cloſely covered with a valve. In the tube place a piſton E, fig. 2. which is made to fit it exactly, and muſt be oiled, that it may move in the tube with the greateſt freedom; in this piſton there is a cock that ſhuts quite cloſe; and from the top of it there goes a cord F, which paſſes through the handle G. The cock of the piſton being cloſed, it is to be let down to the bottom of the tube, and being then drawn up to the top, the air will then ruſh in by the valve at the bottom of the tube, and ſupport the piſton. You are then to turn the cock, ſo as to make a very ſmall vent; and the air paſſing ſlowly through that vent, the piſton will gradually deſcend, and ſhow the hour, either by lines cut in the tube with a diamond, or marked with paint, or by ſmall ſlips of paper painted on the glaſs. If this chronometer ſhould go too faſt or two ſlow, it may be eaſily regulated by altering the poſition of the cock in the piſton, as it is on that the whole depends.

If, inſtead of marking the tube, you would have the time ſhown by a dial, it may be eaſily effected by placing an axis to which the hand of the dial is fixed, directly over the tube, and winding the ſtring to which the piſton is joined round that axis; for then, as the piſton deſcends, the axis will gradually turn the hand, and ſhow the hour: but it muſt be obſerved, that as the deſcent of the piſton is not conſtantly regular, on account of the decreaſe of reſiſtence from the quantity of the ſubjacent air as the piſton deſcends, the axis therefore muſt not be a regular cylinder, but conical like the fuſee of a watch, as in fig. 3. by which means the motion of the hand of the dial will be conſtant and regular.

Fig. 4. repreſents a lamp-chronometer. It conſiſts of a chamber lamp A, which is a cylindrical veſſel about three inches high, and one inch diameter, placed in the ſtand B. The inſide of this veſſel muſt be every where exactly of the ſame diameter. To the ſtand B is fixed the handle C, which ſupports the frame DEFG, about 12 inches high, and four wide. This frame is to be covered with oiled paper, and divided into twelve equal parts by horizontal lines; at the end of which are wrote the numbers for the hours, from 1 to 12, and between the horizontal lines are diagonals that are divided into halves, quarters, *&c.* On the handle B, and cloſe to the glaſs, is fixed the ſtyle or gnomon H. Now, as the diſtance of the ſtyle from the flame of the lamp is only half an inch, if the diſtance of the frame from the ſtyle is only ſix inches, then, while the float that contains the light deſcends, by the decreaſe of the oil, one inch, the ſhadow of the ſtyle on the frame will aſcend twelve inches, that is, its whole length, and ſhow by its progreſſion the regular increaſe of the hours, with their ſeveral diviſions. It is abſolutely neceſſary, however, that the oil uſed in this lamp be always of the ſame ſort and quite pure, and that the wick alſo be conſtantly of the ſame ſize and ſubſtance, as it is on theſe circumſtances, and the uniform figure of the veſſel, that the regular, progreſs of the ſhadow depends.

CHRONOMETER, among muſicians, an inſtrument invented by *Loulie*, a French muſician, for the purpoſe of meaſuring time by means of a pendulum. The form of the inſtrument, as deſcribed by him, is that of an Ionic pilaſter, and is thus deſcribed by Malcolm in his Treatiſe of Muſic, p. 407 —“ The chronometer conſiſts of a large ruler or board, ſix feet or 72 inches long, to be ſet on end; it is divided into its inches, and the numbers ſet ſo as to count upwards; and at every diviſion there is a ſmall round hole, through whoſe centre the line of diviſion runs. At the top of this ruler, about an inch above the diviſion 72, and perpendicular to the ruler, is inſerted a ſmall piece of wood, in the upper ſide of which there is a groove, hollowed along from the end that ſtands out to that which is fixed in the ruler, and near each end of it a hole is made: through theſe holes a pendulum cord is drawn, which runs in the groove: at that end of the cord which comes through the hole fartheſt from the ruler, the ball is hung; and at the other end there is a ſmall wooden pin, which can be put in any of the holes of the ruler: when the pin is in the upmoſt hole at 72, then the pendulum from the top to the centre of the ball muſt be exactly 72 inches; and therefore, whatever hole of the ruler it is put in, the pendulum will be juſt ſo many inches as that figure at the hole denotes. The manner of uſing the machine is this: The compoſer lengthens or ſhortens his pendulum, till one vibration be equal to the deſigned length of his bar, and then the pin ſtands at a certain diviſion, which marks the length of the pendulum; and this number being ſet with the cliff at the beginning of the ſong, is a direction for others how to uſe the chronometer, in meaſuring the time according to the compoſer's deſign: for with the number is ſet the note, crotchet, or minim, whoſe value he would have the vibration to be; which in briſk duple time is beſt a minim or half bar, or even a whole bar, when that is but a minim; and in ſlow time a crotchet. In triple time, it would do well to be the third part or half, or fourth part of a bar; and in the ſimple triples that are allegro, let it be a whole bar. And if, in every time that is allegro, the vibration is applied to a whole or half bar, practice will teach us to ſubdivide it juſtly and equally. Obſerve, that, to make this machine of univerſal uſe, ſome canonical meaſure of the diviſions muſt be agreed upon, that the figure may give a certain direction for the length of the pendulum.

CHROSTASIMA, in natural hiſtory, a genus of pellucid gems, comprehending all thoſe which appear of one ſimple and permanent colour in all lights; ſuch are the diamond, carbuncle, ruby, garnet, amethyſt, ſapphire, beryl, emerald, and the topaz. See DIAMOND, CARBUNCLE, *&c.*

CHRYSA, (anc. geog.), a town of Myſia, on the ſinus Adramyttenus; extinct in Pliny's time: it had a temple of Apollo Smintheus (Homer, Strabo). The country of the fair Chryſeis, who gave firſt riſe to the quarrel between Agamemnon and Achilles.

CHRYSALIS, or AURELIA, in natural hiſtory, a ſtate of reſt and ſeeming inſenſibility, which butterflies, moths, and ſeveral other kinds of inſects, muſt paſs through before they arrive at their winged or moſt perfect ſtate.

In this ſtate, no creatures afford ſo beautiful a variety as the butterfly kinds, and they all paſs through this middle ſtate without one exception. The figure of the aurelia or chryſalis generally approaches to that of a cone, or at leaſt the hinder part of it is in this ſhape; and the creature, while in this ſtate, ſeems to have neither legs nor wings, nor has any power of walking. It ſeems indeed to have hardly ſo much as life. It takes no nouriſhment in this ſtate, nor has it any organs for taking any; and indeed its poſterior part is all that ſeems animated, this having a power of giving itſelf ſome motions. The external covering of the chryſalis is cartilaginous, and conſiderably large, and is uſually ſmooth and gloſſy: but ſome few of them have a few hairs; ſome are alſo as hairy as the caterpillars from which they are produced; and others are rough, and, as it were, ſhagreened all over.

In all of theſe there may be diſtinguiſhed two ſides; the one of which is the back, the other the belly of the animal. On the anterior part of the latter, there may always be diſtinguiſhed certain little elevations running in ridges, and reſembling the fillets wound about mummies: the part whence theſe have their origin, is eſteemed the head of the animal. The other ſide, or back, is ſmooth, and of a rounded figure in moſt of the chryſaliſes; but ſome have ridges on the anterior part, and ſides of this part; and theſe uſually terminate in a point, and make an angular appearance on the chryſalis.

From this difference is drawn the firſt general diſtinction of theſe bodies. They are by this divided into two claſſes; the round and the angular kinds. The firſt are, by the French naturaliſts, called *feves*; from the common cuſtom of calling the chryſalis of the ſilkworm, which is round, by this name.

There is ſomething more regular in this diſtinction than might at firſt be conceived; for the diviſion is continued from the fly-ſtate: the rounded chryſaliſes being almoſt all produced by the *phalenæ*, or moths; and the angular ones by the *papilios*, or day-flies. There are ſeveral ſubordinate diſtinctions of theſe kinds; but, in general, they are leſs different from one another than the caterpillars from whence they are produced.

The head of thoſe of the firſt claſs uſually terminates itſelf by two angular parts, which ſtand ſeparate one from the other, and reſemble a pair of horns. On the back, eminences and marks are diſcovered, which imagination may form into eyes, noſe, chin, and other parts of the human face.

There is a great variety and a great deal of beauty in the figures and arrangement of the eminences and ſpots on the other part of the body of the chryſaliſes of different kinds. It is a general obſervation, that thoſe chryſaliſes which are terminated by a ſingle horn, afford day-butterflies of the kind of thoſe which have buttoned antennæ, and whoſe wings, in a ſtate of reſt, cover the under part of their body, and which uſe all their ſix legs in walking, thoſe of many other kinds uſing only four of them. Thoſe chryſaliſes which are terminated by two angular bodies, and which are covered with a great number of ſpines, and have the figure of a human face on their back in the greateſt perfection, afford butterflies of the day-kind; and of that claſs the characters of which are, their walking on four legs, and uſing the other two, that is, the anterior part, in the manner of arms or hands. The chryſaliſes which have two angular bodies on their heads, but ſhorter than thoſe of the preceding, and whoſe back ſhows but a faint ſketch of the human face, and which have fewer ſpines, and thoſe leſs ſharp, always turn to that ſort of butterfly the upper wings of which are divided into ſegments, one of which is ſo long as to repreſent a tail, and whoſe under wings are folded over the upper part of the back. A careful obſervation will eſtabliſh many more rules of this kind, which are not ſo perfect as to be free from all exceptions; yet are of great uſe, as they teach us in general what ſort of fly we are to expect from the chryſalis, of which we know not the caterpillar, and therefore can only judge from appearances.

Theſe are the principal differences of the angular chryſaliſes; the round ones alſo have their different marks not leſs regular than thoſe.

The greater number of the round chryſaliſes have the hinder part of their body of the figure of a cone; but the upper end, which ought to be its circular plane baſe, is uſually bent and rounded into a ſort of knee: this is uſually called the head of the chryſalis; but there are alſo ſome of this kind, the head of which is terminated by a nearly plane ſurface: ſome of the creeping ten-legged caterpillars give chryſaliſes of this kind, which have each of them two eminences that ſeem to bring them towards the angular kind.

Among the angular chryſaliſes there are ſome whoſe colours ſeem as worthy our obſervation as the ſhapes of the others. Many of them appear ſuperbly clothed in gold. Theſe elegant ſpecies have obtained the name of *chryſalis* and *aurelia*, which are derived from Greek and Latin words, ſignifying gold; and from theſe all other bodies of the ſame kind have been called by the ſame names, though leſs, or not at all, intitled to them. As ſome kinds are thus gilded all over, ſo others are ornamented with this gay appearance in a ſparing manner, having only a few ſpots of it in different places on their back and belly. Theſe obvious marks, however, are not to be depended upon as certain characters of diſtinction: for accidents in the formation of the chryſalis may alter them; and thoſe which naturally would have been gilded all over, may be ſometimes only ſo in part; and either theſe or the others may, by accident, be ſo formed, as to ſhow nothing of this kind at all, but be only of a duſky brown. Thoſe, however, which have neither ſilver nor gold to recommend them to your eyes, do not want other colours, and thoſe beautifully variegated. Some of them are all over of an elegant green, as is the chryſalis of the fennel-caterpillar; others of an elegant yellow; and ſome of a bright greeniſh tinge, variegated with ſpots of a ſhining black: we have a very beautiful inſtance of this laſt kind in the chryſalis of the elegant cabbage-caterpillar. The general colour of the chryſalis of the common butterflies, however, is brown.

Some are alſo of a fine deep black; and of theſe many are ſo ſmooth and gloſſy, that they are equal to the fineſt Indian japan. The common caterpillar of the fig-tree gives an inſtance of one of theſe moſt beautiful gloſſy ones; the caterpillar of the vine affords another of theſe fine black chryſaliſes.

The rounded chryſaliſes do not afford any thing of that variety of colouring ſo remarkably beautiful in the angular ones; they are uſually of a duſky yellow, in different ſhades, and are often variouſly ſpotted with black: but theſe, as well as all other chryſaliſes, before they arrive at their fixed colour, paſs through ſeveral other temporary ones; ſome being of a different colour when firſt produced from the caterpillar, from what they are a few days afterwards; and ſome varying ſo greatly, though only in degree, as not to be diſtinguiſhable, even by the moſt converſant eye, from what they were when firſt produced. The green rough caterpillar of the cabbage has a chryſalis which is green at firſt; and from that gradually goes through all the ſhades of green to faint yellow, which is its laſting colour; and one of the oak caterpillars yields a chryſalis beautifully ſpotted with red at its firſt appearance; but theſe ſpots change to brown for their fixed colour: the third day from their formation uſually fixes their laſting colours; and if they are obſerved to turn black in any part after this time, it is a ſign that they are dead or dying.

The ſeveral ſpecies of inſects, as a fly, ſpider, and an ant, do not differ more evidently from one another in regard to appearance, than do a caterpillar, its chryſalis, and a butterfly produced from it; yet it is certain, that theſe are all the product of the ſame individual egg: and nothing is more certain, than that the creature which was for a while a caterpillar, is, after a certain time, a chryſalis, and then a butterfly. Theſe great changes produced in ſo ſudden a manner, ſeem like the *metamorphoſes* recorded in the fables of the ancients; and indeed it is not improbable that thoſe fables firſt took their origin from ſuch changes.

The parts being diſtinguiſhable in the chryſalis, we eaſily find the difference of the ſpecies of the fly that is to proceed from it. The naked eye ſhows whether it be one of thoſe that have, or of thoſe that have not, a trunk; and the aſſiſtance of a microſcope ſhows the antennæ ſo diſtinctly, that we are able to diſcern whether it belongs to the day or night claſs; and often to what genus, if not the very ſpecies: nay, in the plumoſe horned kinds, we may ſee, by the antennæ, whether a male or female phalæna is to be produced from the chryſalis; the horns of the female being in this ſtate evidently narrower, and appearing leſs elevated above the common ſurface of the body, than thoſe of the male.

All theſe parts of the chryſalis, however, though ſeen very diſtinctly, are laid cloſe to one another, and ſeem to form only one maſs; each of them is covered with its own peculiar membrane in this ſtate, and all are ſurrounded together by a common one; and it is only through theſe that we ſee them; or rather we ſee on theſe the figures of all the parts moulded within, and therefore it requires attention to diſtinguiſh them. The chryſalis is ſoft when firſt produced, and is wetted on the front with a viſcous liquor; its ſkin, though very tender at firſt, dries and hardens by degrees: but this viſcous liquor, which ſurrounds the wings, legs, *&c.* hardens almoſt immediately; and in conſequence faſtens all thoſe limbs, *&c.* into a maſs, which were before looſe from one another: this liquor, as it hardens, loſes its tranſparence, and becomes brown; ſo that it is only while it is yet moiſt that theſe parts are to be ſeen diſtinct.

It is evident from the whole, that the chryſalis is no other than a butterfly, the parts of which are hid under certain membranes which faſten them together; and, when the limbs are arrived at their due ſtrength, they become able to break through theſe membranes, and then expand and arrange themſelves in their proper order.

The firſt metamorphoſis, therefore, differs nothing from the ſecond, except that the butterfly comes from the body of the caterpillar in a weak ſtate, with limbs unable to perform their offices, whereas it comes from the chryſalis perfect.

Hiſtory of Inſects, vol. i. p. 2.—28.

M. Reaumur has given us many curious obſervations on the ſtructure and uſes of the ſeveral coverings that attend the varieties of the caterpillar-kind in this ſtate.

The creatures in general remain wholly immoveable in this ſtate, and ſeem to have no buſineſs in it but a patient attendance on the time when they are to become butterflies; and this is a change that can happen to them only as their parts, before extremely ſoft and weak, are capable of hardening and becoming firm by degrees, by the tranſpiration of that abundant humidity which before kept them ſoft: and this is proved by an experiment of M. Reaumur, who, incloſing ſome chryſaliſes in a glaſs tube, found, after ſome time, a ſmall quantity of water at the bottom of it; which could have come there no other way, but from the body of the incloſed animal. This tranſpiration depends greatly on the temperature of the air; it is increaſed by heat, and diminiſhed by cold; but it has alſo its peculiarities in regard to the ſeveral ſpecies of butterfly to which the chryſalis belongs.

According to theſe obſervations, the time of the duration of the animal in the chryſalis ſtate muſt be, in different ſpecies, very different; and there is indeed this wide difference in the extremes, that ſome ſpecies remain only eight days in this ſtate, and others eight months.

We know that the caterpillar changes its ſkin four or five times during its living in that ſtate; and that all theſe ſkins are at firſt produced with it from the egg, lying cloſely over one another. It parts with, or throws off all theſe one by one, as the butterfly, which is the real animal, all this time within, grows more and more perfect in the ſeveral firſt changes. When it throws off one, it appears in another ſkin exactly of the ſame form; but at its final change from this appearance, that is, when it throws off the laſt ſkin, as the creature within is now arrived at ſuch a degree of perfection as to need no farther taking of nouriſhment, there is no farther need of teeth, or any of the other parts of a caterpillar. The creature, in this laſt change, proceeds in the very ſame manner as in all the former, the ſkin opening at the back, and the animal making its way out in this ſhape. If a caterpillar, when about to throw off this laſt ſkin, be thrown into ſpirits of wine, and left there for a few days, the membranes within will harden, and the creature may be afterwards carefully opened, and the chryſalis taken out, in which the form of the tender butterfly may be traced in all its lineaments, and its eyes, legs, *&c.* evidently ſeen. It is not neceſſary, however, to ſeize upon this exact time for proving the exiſtence of the chryſalis or butterfly in the caterpillar: for if one of theſe animals be thrown into ſpirit of wine, or into vinegar, ſome days before that time, and left there for the fleſh to harden, it may afterwards be diſſected, and all the lineaments of the butterfly traced out in it, the wings, legs, antennæ, *&c.* being as evident here, and as large, as in the chryſalis.

It is very plain from this, that the change of the caterpillar into chryſalis, is not the work of a moment; but is carrying on for a long time before, even from the very hatching of the creature from the egg. The parts of the butterfly, however, are not diſpoſed exactly in the ſame manner while in the body of the caterpillar, as when left naked in the form of the chryſalis: for the wings are proportionally longer and narrower, being wound up into the form of a cord; and the antennæ are rolled up on the head; the trunk is alſo twiſted up and laid upon the head; but this in a very different manner from what it is in the perfect animal, and very different from that in which it lies within the chryſalis; ſo that the firſt formation of the butterfly in the caterpillar, by time arrives at a proper change of the diſpoſition of its parts, in order to its being a chryſalis. The very eggs, hereafter to be depoſited by the butterfly, are alſo to be found not only in the chryſalis, but in the caterpillar itſelf, arranged in their natural, regular order. They are indeed in this ſtate very ſmall and tranſparent; but after the change into the chryſalis, they have their proper colour.

As ſoon as the ſeveral parts of the butterfly, therefore, are arrived at a ſtate proper for being expoſed to the more open air, they are thrown out from the body of the caterpillar, ſurrounded only with their membranes; and as ſoon as they are arrived after this at a proper degree of ſtrength and ſolidity, they labour to break through theſe thinner coverings, and to appear in their proper and natural form. The time of their duration in this ſtate of chryſalis is very uncertain, ſome remaining in it only a few days, others ſeveral months, and ſome almoſt a year in appearance. But there is a fallacy in this that many are not aware of. It is natural to think, that as ſoon as the creature has incloſed itſelf in its ſhell, be that of what matter it will, it undergoes its change into the chryſalis ſtate. And this is the caſe with the generality: yet there are ſome which are eight or nine months in the ſhell before they become chryſaliſes; ſo that their duration in the real chryſalis ſtate is much ſhorter than it naturally appears to be. M. Reaumur carefully watched the auriculated caterpillar of the oak in its ſeveral changes, and particularly from its chryſalis, which is of this laſt kind, into the fly; and has given an account of the method of this as an inſtance of the general courſe of nature in theſe operations.

The membranes which envelope the creature in this chryſalis ſtate are at firſt tough and firm, and immediately touch the ſeveral parts of the incloſed animal; but by degrees, as theſe parts harden, they become covered, ſome with hairs, and others with ſcales. Theſe, as they continue to grow, by degrees ſall off the ſeveral particular membranes which cover the parts on which they are placed, to a greater diſtance, and by degrees looſen them from the limbs. This is one reaſon of thoſe membranes drying and becoming brittle.

The middle of the upper part of the CORSKLET is uſually marked with a line which runs in a longitudinal direction: and this part is always more elevated than the reſt, even in the conic kinds, which are no otherwiſe angular. This line is in ſome very bold and plain; in others it is ſo faint as not to be diſtinguiſhable without glaſſes; but it is always in the midſt of that line that the ſhell begins to open. The motion of the head of the butterfly backwards firſt occaſions this crack; and a few repetitions of the ſame motion open it the whole length of the line.

The clearing itſelf, however, entirely, is a work of more time in this caſe, than is the paſſing of the chryſalis out of the body of the caterpillar. In that caſe there is a crack ſufficiently large in the ſkin of the back, and the whole chryſalis being looſe comes out at once. But in this caſe, every particular limb, and part of the body, has its ſeparate caſe; and theſe are almoſt inconceivably thin and tender, yet it is neceſſary that every part be drawn out of them before it appear naked to the open air. As ſoon as all this is effected, and the animal is at full liberty, it either continues ſome time upon the remains of its covering, or creeps a little way diſtant from it, and there reſts. The wings are what we principally admire in this creature. Theſe are at this time ſo extremely folded up, and placed in ſo narrow a compaſs, that the creature ſeems to have none at all: but they by degrees expand and unfold themſelves; and finally, in a quarter of an hour, or half an hour at the utmoſt, they appear at their full ſize, and in all their beauty. The manner of this ſudden unfolding of the wings is this: the ſmall figure they make when the creature firſt comes out of its membranes, does not prevent the obſerving that they are at that time conſiderably thick. This is owing to its being a large wing folded up in the niceſt manner, and with folds ſo arranged as to be by no means ſenſible to the eye, for the wing is never ſeen to unfold; but, when obſerved in the moſt accurate manner ſeems to grow under the eye to this extent. When the creature is firſt produced from the ſhell, it is every where moiſt and tender; even its wings have no ſtrength or ſtiffneſs till they expand themſelves; but they then dry by degrees, and, with the other parts, become rigid and firm. But if any accident prevents the wings from expanding at their proper time, that is, as ſoon as the creature is out of its ſhell, they never afterwards are able to expand themſelves; but the creature continues to wear them in their contracted and wholly uſeleſs ſtate; and very often, when the wings are in part extended before ſuch an accident happens, it ſtops them in a partial extenſion, and the creature muſt be contented to paſs its whole life with them in that manner.

M. Reaumur has proved, that heat and cold make great differences in the time of hatching the butterfly from its chryſalis ſtate: and this he particularly tried with great accuracy and attention, by putting them in veſſels in warm rooms, and in ice-houſes; and it ſeemed wholly owing to the haſtening or retarding the evaporation of the abundant humidity of the animal in the chryſalis ſtate, that it ſooner or later appeared in the butter-fly form. He varniſhed over ſome chryſaliſes, in order to try what would be the effect of thus wholly preventing their tranſpiration; and the conſequence was, that the butterfly came forth from theſe two months later than their natural time. Thus was the duration of the animal in this ſtate lengthened; that is, its exiſtence was lengthened: but without any advantage to the creature, ſince it was in the time of its ſtate of inaction, and probably of inſenſibility.

Though this was of no conſequence, M. Reaumur deduces a hint from it that ſeems to be of ſome uſe. He obſerves, that hens eggs, of which we make ſo many uſes, and eat in ſo many forms, are properly a ſort of chryſalis of the animal; their germ, after they are impregnated by the cock, containing the young animal alive, and waiting only a due degree of warmth to be hatched, and appear in its proper form. Eggs tranſpire notwithſtanding the hardneſs of their ſhells; and when they have been long kept, there is a road found near one of their ends, between the ſhell and the internal membrane, this is a mark of their being ſtale, and is the effect of an evaporation of part of their humidity: and the ſame varniſh which had been uſed to the chryſalis, being tried on eggs, was found to preſerve them for two years, as freſh as if laid but the ſame day, and ſuch as the niceſt palate could not diſtinguiſh from thoſe that were ſo. See EGGS.

It is not yet known how much farther this uſeful ſpeculation might be carried, and whether it might not be of great uſe even to human life, to invent ſomething that ſhould act in the manner of this varniſh, by being rubbed over the body, as the *athletæ* did of old, and the ſavages of the Weſt Indies do at this time, without knowing why. But to return to the inſects which are the ſubjects of this article; their third ſtate, that in which they are winged, is always very ſhort, and ſeems deſtined for no other action but the propagation of the ſpecies. See PAPILIO.

CHRYSANTHEMUM, CORN-MARIGOLD: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is naked; the pappus marginated, or conſiſting only of a border: the calyx hemiſpherical and imbricated, with the marginal ſcales membranaceous. There are 19 ſpecies, of which the following are the moſt remarkable: 1. The ſerotinum is a native of North America. The roots of this plant creep far under the ſurface, and ſend up ſtrong ſtalks more than four feet high, garniſhed with long ſawed leaves ending in points. Theſe ſtalks divide upward into many ſmaller; each being terminated by a large, white, radiated flower, which appears in the end of Auguſt or September. 2. The coronarium hath been long cultivated in the gardens on account of the beauty of its flowers. It grows to the height of three feet, with a ſingle upright ſtalk divided into numerous branches, garniſhed with pinnated leaves, and crowned with elegant compound flowers of different colours and properties. The varieties are, ſingle and double flowers of a cream-colour; yellow; yellow and white: brimſtone-coloured; fiſtular, or quilled; or thoſe with finely jagged leaves, and flowers of all the above colours and properties. All the varieties begin flowering in July: the flowers are exceedingly numerous, and exhibit a conſtant ſucceſſion of full bloom till November; and both ſingle and double are ſucceeded by abundance of ſeed. 2. The puteſcens is a native of the Canary iſlands. It riſes with a ſhrubby ſtalk near two feet high, dividing into many branches, which are garniſhed with pretty thick ſucculent leaves, of a greyiſh colour, cut into many ſegments. The flowers come out from the wings of the leaves, growing upon naked footſtalks ſingly, which greatly reſemble thoſe of chamomile. There is a ſucceſſion of flowers on the ſame plant for the greateſt part of the year, for which it is chiefly eſteemed. This plant will perfect ſeeds in Britain when the ſeaſons are favourable.

Culture. The firſt kind multiplies very faſt by its creeping roots, and will thrive in any ſoil or ſituation. The ſecond may be raiſed in abundance from ſeed, either in a hot-bed or warm border, in the ſpring, for tranſplanting; alſo by cuttings and ſlips of their branches in autumn. The latter method is practiſed only for the propagation of the fine doubles, for an early bloom the following ſummer; and the beſt time to perform it is in September, or early in October. Cut off at that time a quantity of the robuſt ſide ſhoots, from three to ſix inches long, without flowers; diveſt them of the lower leaves, and plant many of them together in large pots, within an inch or two of their tops, and two or three inches apart, give ſome water, and place them in the ſhade during the hot weather: by the end of October they will be rooted, when the pots are to be removed either into a greenhouſe or garden-frame, for the winter; but the latter is the moſt eligible, where they may enjoy the full air in mild weather, and have occaſional ſhelter from froſt. In April they may be tranſplanted ſingly into borders and ſome in pots. The plants thus raiſed will flower a month or ſix weeks ſooner the ſucceeding ſummer than thoſe raiſed in the ſpring from ſeed; but as they ſoon become barren, it is proper to have always a quantity of plants raiſed from the ſeed. The third ſort may be raiſed either from ſeeds or cuttings, but requires to be ſheltered in the green-houſe in winter.

CHRYSES, the prieſt of Apollo, father of Aſtynome, called from him *Chryſeis.* When Lyrneſſus was taken, and the ſpoils divided among the conquerors, Chryſeis fell to the ſhare of Agamemnon. Chryſes upon this went to the Grecian camp to ſolicit his daughter's reſtoration; and when his prayers were fruitleſs, he implored the aid of Apollo, who viſited the Greeks with a plague, and obliged them to reſtore Chryſeis.

CHRYSIPPUS, a ſtoic philoſopher, born at Solos in Cilicia, was diſciple to Cleanthus, Zeno's ſucceſſor. He wrote many books, ſeveral of which related to logic. None of the philoſophers ſpoke in ſtronger terms of the fatal neceſſity of every thing, nor more pompouſly of the liberty of man, than the Stoics, Chryſippus in particular. He was ſo conſiderable among them, as to eſtabliſh it into a proverb, that if it had not been for Chryſippus, the porch had never been. Yet the Stoics complained, as Cicero relates, that he had collected ſo many arguments in favour of the ſceptical hypotheſis, that he could not anſwer them himſelf; and thus had furniſhed Carneades, their antagoniſt, with weapons againſt them. There is an apophthegm of this philoſopher preſerved, which does him honour. Being told that ſome perſons ſpoke ill of him, "It is no matter (ſaid he), I will live ſo that they ſhall not be believed."

CHRYSIS, or GOLDEN-FLY, in natural hiſtory: A genus of inſects belonging to the order of hymenoptera. The mouth is armed with jaws, but has no proboſcis; the antennæ are filiform, bent, and conſiſt of 12 articulations; the abdomen is arched, with a ſcale on each ſide; the anus is dentated, and armed with a ſting; the wings lie plain; and the body appears as if gilt. There are ſeveral ſpecies; but the ignita, or flaming chryſis, is beautified with the moſt reſplendent colours. The fore-part of its head is green and gold, and the hinder of a lovely azure. The thorax is likewiſe azured over, with a mixture of green, and terminates at its extremity with ſharp points on both ſides. The abdomen is green and gold before, and of a coppery-red behind, imitating molten copper highly poliſhed. The whole inſect is dotted on its upper part, which gives it a great reſplendency of colour. The antennæ are black, and legs green intermixed with gold. This ſpecies dwells in holes of walls between the ſtones, and in the mortar that cements them. It is often ſeen iſſuing from ſuch holes, where it neſtles and performs its work. The larvæ, which reſemble thoſe of the waſp, likewiſe inhabit the holes of decayed walls.

CHRYSITRIX, in botany: a genus of the dioecia order, belonging to the polygamia claſs of plants. In the hermaphrodite the glume is two-valved, the corollæ from chaff numerous and briſtly; many ſtamina, one within each chaff; one piſtillum. The male is the hermaphrodite; there is no piſtillum.

CHRYSOBALANUS, COCOA PLUM: A genus of the monogynia order, belonging to the icoſandria claſs of plants; and in the natural method ranking under the 36th order, *Pomaceæ.* The calyx is quinquefid, the petals five; plum-kernel five furrowed and five-valved. There is only one ſpecies, the icaco, which is a native of the Bahama iſlands and many other parts of America, but commonly grows near the ſea. It riſes with a ſhrubby ſtalk eight or nine feet high, ſending out ſeveral ſide-branches, which are covered with a dark brown bark. The flowers are white, and are ſucceeded by plums like damſons; ſome blue, ſome red, and others yellow. The ſtone is ſhaped like a pear, and has five longitudinal furrows. The plums have a ſweet luſcious taſte, and are brought to the tables of the inhabitants, by whom they are much eſteemed.

CHRYSOCOMA, GOLDY-LOCKS: A genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ.* The receptacle is na-

naked; the pappus ſimple; the calyx hemiſpherical and imbricated; the ſtyle hardly longer than the florets. There are nine ſpecies, the moſt remarkable of which are, the linoſyris, the coma aurea, and the cornua. Theſe are herbaceous flowering perennials, growing from one to two feet high, ornamented with narrow leaves, and compound floſcular flowers of a yellow colour. They are eaſily propagated by dividing the roots or by cuttings; but the two laſt require to be ſheltered in the green-houſe in winter.

CHRYSOGONUM, in botany: A genus of the polygamia neceſſaria order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ*. The receptacle is paleaceous; the pappus monophyllous, and tridented; the calyx pentaphyllous; the ſeeds wrapped up each in a tetraphyllous calyculus, or little cup.

CHRYSOLARUS (Emanuel), one of thoſe learned men in the 14th century who brought the Greek literature into the weſt. He was a man of rank; and deſcended from an ancient family, ſaid to have removed with Conſtantine from Rome to Byzantium. He was ſent into Europe by the emperor of the eaſt to implore the aſſiſtance of the Chriſtian princes. He afterwards taught at Florence, Venice, Pavia, and Rome; and died at Conſtantinople, in 1415, aged 47. He wrote a Greek grammar, and ſome other ſmall pieces.

CHRYSOLITE, or YELLOWISH-GREEN TOPAZ; a precious ſtone of a graſs green colour, found in the Eaſt Indies, Brazil, Bohemia, Saxony, Spain, in Auvergne and Bourbon in France, and in Derbyſhire in England. Some are likewiſe found with volcanic lavas, as in the Vevarais, where ſome large lumps have been ſeen of 20 or 30 pounds weight; but it is remarkable, that ſome of theſe chryſolites are partly decompoſed into an argillaceous ſubſtance. All chryſolites, however, are far from being of the ſame kind. The oriental is the ſame with the peridot, and differs only by its green hue from the ſapphires, topazes, and rubies of the ſame denomination. This becomes electric by being rubbed; has a priſmatic form of ſix, or ſometimes of five ſtriated faces; and does not loſe its colour or tranſparency in the fire, which the common chryſolite often does; becoming either opaque, or melting entirely in a ſtrong heat. The inſtant it melts, it emits a phoſphoric light like the baſis of alum and gypſeous ſpar: with borax it produces a thin colourleſs glaſs. Its ſpecific gravity is between 3.600 and 3.700; according to Briſſon it is 2.7821, or 2.6923; and that of the Spaniſh chryſolite 3.0989.

The ſubſtance of this precious ſtone is lamellated in the direction of the axis of its primitive form: but the chryſolite from Saxony is foliated in a perpendicular direction to the ſame axis. The chryſolite of the ancients was the ſame gem which is now called *topaz*, and the name of itſelf indicates that it ought to be ſo. Pliny ſays that the colour of the chryſolite is yellow like gold.

CHRYSOLITE-*Paſte*, a kind of glaſs made in imitation of natural chryſolite, by mixing two ounces of prepared cryſtal with ten ounces of red-lead, adding 12 grains of crocus martis made with vinegar; and then baking the whole for 24 hours, or longer in a well luted cucurbit.

CHRYSOMELA, in zoology, a genus of inſects belonging to the order of coleoptera. The antennæ are ſhaped like bracelets, and thicker on the outſide; and neither the breaſt nor the elytra are marginated. There are no leſs than 122 ſpecies enumerated by Linnæus, principally diſtinguiſhed by differences in their colour. They are to be found almoſt every where, in woods, gardens, &c. Their progreſſive motion is ſlow; and ſome when caught emit an oily liquor of a diſagreeable ſmell. The glittering colours with which ſeveral ſpecies of Chryſomelæ are adorned, and which ſeem to exhibit the brilliancy of gold and copper, have occaſioned their bearing that pompous name. The larvæ of theſe inſects have in general an oval body, rather oblong and ſoft; on the fore-part of which are ſituated ſix feet, which are ſcaly, as is alſo the head. They prey upon the ſubſtance of leaves, rejecting the fibrous part. Thoſe of the leaping chryſomelæ infeſt the cotyledons and tender leaves of plants. Of this genus is that very pernicious inſect called by the country people the *turnip fly*, which infeſts turnips and many crops in the garden, deſtroying often whole fields while in their ſeedling leaves. In very hot ſummers they abound to an amazing degree, and, as you walk in a field or in a garden, make a pattering like rain, by jumping on the leaves of the turnips or cabbages. See Plate CXLIX.

CHRYSOPHYLLUM, or BULLY-TREE: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 43d order, viz. *Dumoſæ*. The corolla is campanulated, decemfid, with the ſegments alternately a little patent. The fruit is a ten-ſeeded berry. There are two ſpecies, the cainito and glabrum, both natives of the Weſt Indies. The firſt riſes 30 or 40 feet high, with a large trunk covered with a brown bark, and divides into many flexible ſlender branches, which generally hang downward, garniſhed with ſpear-ſhaped leaves, whoſe under ſides are of a bright ruſſet colour. The flowers come out at the extremities of the branches diſpoſed in oblong bunches, which are ſucceeded by fruit of the ſize of a golden pippin, that are very rough to the palate, and aſtringent; but when kept ſome time mellow, as is practiſed here with medlars, they have an agreeable flavour. The ſecond ſort never riſes to the height of the firſt, nor do the trunks grow to half the ſize; but the branches are ſlender and garniſhed with leaves like thoſe of the firſt. The flowers come out in cluſters from the ſide of the branches, which are ſucceeded by oval ſmooth fruit about the ſize of a bergamot pear. This contains a white clammy juice when freſh; but after being kept a few days, it becomes ſweet, ſoft, and delicious. Incloſed are four or five black ſeeds about the ſize of thoſe of a pompkin. Both theſe plants are frequently preſerved in gardens where there are large ſtoves, and are propagated by ſeeds, but the plants can never bear the open air in Britan.

CHRYSOPLENIUM, in botany: a genus of the digynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 12th order, *Succulentæ*. The calyx is quadrifid or quinquefid, and coloured; no corolla; the capſule biroſtrated, unilocular and polyſpermous.

CHRYSOPRASUS, or CHRYSOPRASIUS, the 10th of the precious ſtones mentioned in the Revelations, as forming the foundation of the heavenly Jeruſalem. The chryſopraſius is by mineralogiſts reckoned to be a variety of the chryſolite, and by Cronſtedt called the *yellowiſh green and cloudy topaz*. He conjectures that it may perhaps be the ſubſtance which ſerves as a matrix to the chryſolite; as thoſe that he had ſeen were like the clear veined quartz, called in Sweden *milk cryſtal*, which is the firſt degree of cryſtallization.

The chryſopraſus, according to M. Magellan, is of a green colour, deeper than the chryſolite, but with a yellowiſh tinge inclining to blue like the green leek. M. Achard ſays that it is never found chryſtallized, and that it is ſemitranſparent. By others it is reckoned among the quartz, and its colour is ſuppoſed to be owing to the mixture of cobalt, as it gives a fine blue glaſs when melted with borax, or with fixed alkali. Mr Achard, however, found the glaſs of a deep yellow when the fuſion was made with borax; and that it really contains ſome calx of copper inſtead of cobalt. Mr Dutens ſays, that ſome gold has been found in this kind of ſtone: but this laſt belongs in all probablity, ſays M. Magellan, to another claſs of ſubſtances, viz. the vitreous ſpars.

To the latter belongs moſt probably the aventurine, whoſe colour is generally a yellow-brown red; though ſometimes it inclines more to the yellow, or greeniſh, than to the red. Theſe ſtones are not quite tranſparent: ſome indeed ſhine with ſuch a brilliancy, as to render them of conſiderable value, but they are very rare. The common aventurine is but an artificial glaſs of various colours with which powder of gold has been mixed; and theſe imitated aventurines ſo frequently excel the native ones in ſplendor, that the eſteem of the latter is now much lowered. With regard to the chryſopraſus, its name from πρασον, ſhows it to be of a greeniſh-blue colour, like the leaves of a leek; it only differs from the chryſolite in its bluiſh hue.

CHRYSOSTOM (St John), a celebrated patriarch of Conſtantinople, and one of the moſt admired fathers of the Chriſtian church, was born of a noble family at Antioch about the year 347. He ſtudied rhetoric under Libavius, and philoſophy under Andragathus: after which he ſpent ſome time in ſolitude in the mountains near Antioch; but the auſterities he endured having impaired his health, he returned to Antioch, where he was ordained deacon by Meletius. Flavian, Meletius's ſucceſſor, raiſed him to the office of preſbyter five years after; when he diſtinguiſhed himſelf ſo greatly by his eloquence, that he obtained the ſurname of *Golden mouth*. Nectarius patriarch of Conſtantinople, dying in 397, St Chryſoſtom, whoſe fame was ſpread throughout the whole empire, was choſen in his room by the unanimous conſent of both the clergy and the people. The emperor Arcadius confirmed this election, and cauſed him to leave Antioch privately, where the people were very unwilling to part with him. He was ordained biſhop on the 26th of February 398; when he obtained an order from the emperor againſt the Eunomians and Montaniſts; reformed the abuſes which ſubſiſted amongſt his clergy: retrenched a great part of the expences in which his predeceſſors had lived, in order to enable him to feed the poor and build hoſpitals; and preached with the utmoſt zeal againſt the pride, luxury, and avarice of the great. But his pious liberty of ſpeech procured him many powerful enemies. He differed with Theophilus of Alexandria, who got him depoſed and baniſhed; but he was ſoon recalled. After this, declaiming againſt the dedication of a ſtatue erected to the empreſs, ſhe baniſhed him into Cucuſus in Armenia, a moſt barren unhoſpitable place; afterwards, as they were removing him from Petyus, the ſoldiers treated him ſo roughly, that he died by the way, A. D. 407. The beſt edition of his works is that publiſhed at Paris in 1718, by Mountfaucon.

CHRYSTAL. See CRYSTAL.

CHUB, or CHUBB, in ichthyology. See CYPRINUS.

The reſorts of this fiſh are eaſily found; for they are generally holes, overſhaded by trees, and this fiſh will be ſeen floating in ſuch almoſt on the ſurface of the water in a hot day in great numbers. They are but a poor fiſh for the table, and are very full of bones; but they entertain the angler very much, and are of the number of thoſe that are eaſily taken. The beſt manner of fiſhing for him is thus: prepare a very ſtrong rod of a ſufficient length; fix to the hook a graſshopper; place yourſelf ſo as to be perfectly out of ſight of the fiſh, and drop in the bait about two feet from the place where a large chub lies; if he does not ſee the angler he very ſeldom fails biting, and is immediately taken; but he is ſo ſtrong a fiſh that he ſhould be taken out carefully, after a great deal of playing, otherwiſe the tackle will be in danger; a beetle, or any large fly, will anſwer the purpoſe in the place of a graſshopper: and if none of them are to be had, the method of fiſhing muſt be altered, and the line be long enough for fiſhing at the bottom. In March and April this fiſh is to be caught with large red worms; in June and July with flies, ſnails, and cherries; but in Auguſt and September the proper bait is good cheeſe pounded in a mortar, with ſome ſaffron, and a little butter; ſome make a paſte of cheeſe and Venice turpentine for the chub in winter, at which ſeaſon this fiſh is better than at any other; the bones are leſs troubleſome in this ſeaſon, and the fleſh is more firm and better taſted; the row is alſo well flavoured in general. The angler muſt keep this bait for this fiſh at the bottom in cold weather, and near the top in hot, and the fiſh will bite eagerly.

CHUBB (Thomas), a noted polemical writer, born at Eaſt Harnham, a village near Saliſbury, England, in 1679. He was put apprentice to a glover at Saliſbury, and afterwards entered into partnerſhip with a tallow-chandler. Being a man of ſtrong natural parts, he employed all his leiſure in reading; and though a ſtranger to the learned languages, became tolerably verſed in geography, mathematics, and other branches of ſcience. His favourite ſtudy was divinity; and he formed a little ſociety for the purpoſe of debating upon religious ſubjects, about the time that the Trinitarian controverſy was ſo warmly agitated between Clarke and Waterland. This ſubject, therefore, falling under the cognizance of Chubb's theological aſſembly, he at their requeſt drew up and arranged his ſentiments on it, in a kind of diſſertation; which was afterward publiſhed under the title of *The Supremacy of the Father aſſerted*, &c. In this piece Mr Chubb ſhowed great talents in reaſoning; and acquired ſo much reputation, that the late Sir Joſeph Jekyl, maſter of the rolls, took him into his family to enjoy his converſation: but though he is ſaid to have been tempted to remain with him by the offer of a genteel allowance, he did not continue with him many years; but choſe to return to his friends at Saliſbury. He publiſhed afterwards a 4to volume of tracts, which Mr Pope informs his friend Gay, he "read through with admiration of the writer, though not always with approbation of his doctrine." He died a ſingle man in the 68th year of his age, and left behind him 2 vols. of poſthumous tracts, in which he appears to have had little or no belief in revelation. But however licentious his way of thinking may be deemed, nothing irregular or immoral has been fairly imputed to him in his life and actions.

CHUDLEIGH (Lady Mary), was born in 1656, and married to Sir George Chudleigh, baronet, by whom ſhe had ſeveral children: her poems and eſſays have been much admired for delicacy of ſtyle. She died in 1710; and is ſaid to have written ſeveral dramatic pieces, which, though not printed, are preſerved in the family.

CHUPMESSAHITES, a ſect among the Mahometans, who believe that Jeſus Chriſt is God, and the true Meſſiah, the Redeemer of the world; but without rendering him any public or declared worſhip. The word in the Turkiſh language ſignifies *protector of the Chriſtians*. Ricaut ſays, there are abundance of theſe Chupmeſſahites among the people of faſhion in Turkey, and ſome even in the ſeraglio.

CHURCH, has different ſignifications, according to the different ſubjects to which it is applied.

1. It is underſtood of the collective body of Chriſtians, or all thoſe over the face of the whole earth who profeſs to believe in Chriſt, and acknowledge him to be the Saviour of mankind. This is what the ancient writers call the *catholic* or *univerſal church*. Sometimes the word church is conſidered in a more extenſive ſenſe, and divided into ſeveral branches; as the church militant is the aſſembly of the faithful upon earth; the church triumphant, that of the faithful already in glory; to which the Papiſts add the church patient; which, according to their doctrines, is that of the faithful in purgatory.

2. Church is applied to any particular congregation of Chriſtians, who aſſociate together and concur in the participation of all the inſtitutions of Jeſus Chriſt, with their proper paſtors and miniſters. Thus we read of the church of Antioch, the church of Alexandria, the church of Theſſalonica, and the like.

3. Church denotes a particular ſect of Chriſtians diſtinguiſhed by particular doctrines and ceremonies. In this ſenſe we ſpeak of the Romiſh church, the Greek church, the Reformed church, the church of England, &c.

The Latin or Weſtern church, comprehends all the churches of Italy, France, Spain, Africa, the north, and all other countries whither the Romans carried their language. Great Britain, part of the Netherlands, of Germany, and of the North, have been ſeparated from hence ever ſince the time of Henry VIII.; and conſtitute what we call the Reformed church, and what the Romaniſts call the weſtern ſchiſm.

The Greek or Eaſtern church, comprehends the churches of all the countries anciently ſubject to the Greek or eaſtern empire, and through which their language was carried; that is, all the ſpace extended from Greece to Meſopotamia and Perſia, and thence into Egypt. This church has been divided from the Roman, ever ſince the time of the emperor Phocas.

The Gallican church, denotes the church of France, under the government and direction of their reſpective biſhops and paſtors. This church has always enjoyed certain franchiſes and immunities; not as grants from popes, but as derived to her from her firſt original, and which ſhe has taken care never to relinquiſh. Theſe liberties depend upon two maxims; the firſt, that the pope has no authority or right to command or order any thing either in general or in particular, in which the temporalities and civil rights of the kingdom are concerned; the ſecond, that notwithſtanding the pope's ſupremacy is owned in caſes purely ſpiritual, yet in France his power is limited and regulated by the decrees and canons of ancient councils received in that realm.

4. The word church is uſed to ſignify the body of eccleſiaſtics, or the clergy, in contradiſtinction to the laity. See CLERGY.

5. Church is uſed for the place where a particular congregation or ſociety of Chriſtians aſſemble for the celebration of divine ſervice. In this ſenſe churches are variouſly denominated, according to the rank, degree, diſcipline, &c. as Metropolitan church, Patriarchal church, Cathedral church, Parochial church, Collegiate church, &c. See METROPOLIS, PATRIARCH, &c.

In eccleſiaſtical writers, we meet with *grand church*, for the chief church of a place; particularly in the Greek lithurgy, for the church of St Sophia at Conſtantinople, the ſee of the patriarch, founded by Conſtantine, and conſecrated under Juſtinian. It was at that time ſo magnificent, that Juſtinian is ſaid to have cried out in the conſecration thereof, Ενικησα σε, Σολομων; *I have outdone thee, Solomon*. The dome, which is ſaid to have been the firſt that was built, is 330 feet diameter.

The firſt church publicly built by the Chriſtians, ſome authors maintain to be that of St Saviour at Rome, founded by Conſtantine; others contend, that ſeveral churches abroad, called by the name of *St Peter Vivus*, were built in honour of that apoſtle during his life-time.

CHURCH, with regard to architecture, Daviler defines a large oblong edifice, in form of a ſhip, with nave, choir, iſles, chapel, belfry, &c. See each part under its proper head.

CHURCH, ſimple, is that which has only a nave and a choir.

CHURCH with Iſles, that which has a row of porticos, in form of vaulted galleries, with chapels in its circumference.

CHURCH in a Greek croſs, that where the length of the traverſe part is equal to that of the nave; ſo called becauſe moſt of the Greek churches are built in this form.

CHURCH in a Latin croſs, that whoſe nave is longer than the croſs part, as in moſt of the Gothic churches.

CHURCH in Rotundo, that whoſe plan is a perfect circle, in imitation of the Pantheon.

For the form of the ancient Greek churches, when they had all their parts, it was as follows: firſt was a porch, or portico, called the *vaunt-nave*, προναος: this was adorned with columns on the outſide, and on the inſide ſurrounded with a wall; in the middle whereof was a door, through which they paſſed into a ſecond portico. The firſt of theſe porticos was deſtined for *the energumeni*, and penitents in the firſt ſtage of their repentance; the ſecond was much longer, deſtined for penitents of the ſecond claſs, and the catechumens, and hence called ναρθηξ, *ferula*, becauſe thoſe placed in it began to be ſubject to the diſcipline of the church. Theſe two porticos took up about one-third of the ſpace of the church. From the ſecond portico, they paſſed into the nave, ναος, which took up near another third of the church. In the middle, or at one ſide of the nave, was the ambo, where the deacons and prieſts read the goſpel, and preached. The nave was deſtined for the reception of the people, who here aſſiſted at prayers.

Near the entrance of this was the baptiſtery or font. Beyond the nave was the choir, χορος, ſet with ſeats, and round: the firſt ſeat on the right, next the ſanctuary, being for the chantor, or *choragus*.

From the choir they aſcended by ſteps to the ſanctuary, which was entered at three doors. The ſanctuary had three apſides in its length; a great one in the middle under which was the altar, crowned with a baldachin, ſupported by four columns. Under each of the ſmall apſides, was a kind of table or cupboard, in manner of a beaufet.

Though, of the Greek churches now remaining, few have all the parts above deſcribed, moſt of them having been reduced to ruins or converted into moſques.

High-CHURCH was a denomination originally given to thoſe otherwiſe called *Non-jurors*, who refuſed to acknowledge the title of William III. to the crown of Great Britain, under a notion that James II. though excluded, was ſtill their rightful ſovereign. This appellation was given them, becauſe they entertained high notions of the dignity and power of the church, and the extent of its prerogative and juriſdiction. And thoſe, on the contrary, were called *low-church men*, who diſapproved of the ſeceſſion and obſtinacy of the non-jurors, diſtinguiſhed themſelves by their moderation toward diſſenters, and were leſs ardent in extending the limits of church authority. The denomination of *high-church men* is now more generally applied to all who form pompous and ambitious conceptions of the authority and juriſdiction of the church, and who would raiſe it to an abſolute independence on all human power.

CHURCH-Ale. See *WHITSUN-Ale*.

CHURCH-Reeves, the ſame with *CHURCH-Wardens*.

CHURCH-Scot, or *Churcheſſet*, a payment or contribution, by the Latin writers frequently called *primitiæ ſeminum*; being, at firſt, a certain meaſure of wheat, paid to the prieſt on St Martin's day, as the firſt fruits of harveſt. This was enjoined by the laws of king Malcom IV. and Canute, c. 10. But after this, *Church-ſcot* came to ſignify a reſerve of corn-rent paid to the ſecular prieſts, or to the religious; and ſometimes was taken in ſo general a ſenſe as to include poultry, or any other proviſion that was paid in kind to the religious. See TITHE.

CHURCH-Wardens (*eccleſiæ guardiani*), in the Engliſh eccleſiaſtical polity, are the guardians or keepers of the church, and repreſentatives of the body of the pariſh. They are ſometimes appointed by the miniſter, ſometimes by the pariſh, ſometimes by both together, as cuſtom directs. They are taken, in favour of the church, to be, for ſome purpoſes, a kind of corporation at the common law; that is, they are enabled, by that name, to have a property in goods and chattels, and to bring actions for them, for the uſe and profit of the pariſh. Yet they may not waſte the church goods, but may be removed by the pariſh, and then called to account by actions at common law: but there is no method of calling them to account but by firſt removing them; for none can legally do it but thoſe who are put in their place. As to lands or other real property, as the church, church-yard, &c. they have no ſort of intereſt therein; but if any damage is done thereto, the perſon only or vicar ſhall have the action. Their office alſo is to repair the church, and make rates and levies for that purpoſe: but theſe are recoverable only in the eccleſiaſtical courts. They are alſo joined with the overſeers in the care and maintenance of the poor. They are to levy a ſhilling forfeiture on all ſuch as do not repair to church on Sundays and holidays; and are empowered to keep all perſons orderly while there; to which end it has been held that a church-warden may juſtify the pulling off a man's hat, without being guilty of either an aſſault or a treſpaſs. There are alſo a multitude of other petty parochial powers committed to their charge by divers acts of parliament.

CHURCHILL (Sir Winſton), the father of the great duke of Marlborough, was deſcended from an ancient and honourable family in Dorſetſhire. He was born at Wotton Glanvile in that county in 1610; and educated at St John's college at Oxford. He engaged in the cauſe of his unfortunate ſovereign Cha. I. for which he ſuffered ſeverely in his fortune; and having married while young, Elizabeth, the daughter of Sir John Drake of Aſhe in Devonſhire, ſhe was forced to ſeek a refuge in her father's houſe, when Mr Churchill's misfortunes left him none that he could call his own; and there moſt of his children were born. After the reſtoration, he was elected a burgeſs to ſerve in parliament for the borough of Weymouth; and, in 1669, his majeſty was pleaſed to confer on him the honour of knighthood. The next year he was made one of the commiſſioners of claims in Ireland; and upon his return from thence, was conſtituted one of the clerks comptrollers of the green-cloth: but writing a kind of political eſſay upon the Hiſtory of England, which gave great offence to the parliament, he was, in 1678, diſmiſſed from his poſt. He was, however, ſoon reſtored to it again; and lived to ſee his eldeſt ſurviving ſon raiſed to the peerage, and the reſt of his children in a fair way to promotion. He died in 1688.

CHURCHILL (John) Duke of Marlborough, and prince of the holy Roman empire, a moſt renowned general and ſtateſman, was born at Aſhe in Devonſhire in 1650. He was eldeſt ſon of Sir Winſton Churchill, who carried him to court while very young, and where he was particularly favoured by James duke of York, afterwards king James II. when only twelve years of age. In 1666, he was made an enſign of the guards during the firſt Dutch war; and afterwards improved himſelf greatly in the military art at Tangier. In 1672, Mr Churchill attended the duke of Monmouth who commanded a body of auxiliaries in the French ſervice, and was ſoon after made a captain in the duke's own regiment. At the ſiege of Nimeguen, which happened in that campaign, he diſtinguiſhed himſelf ſo much that he was taken notice of by the celebrated marſhal Turenne, who beſtowed on him the name of the *handſome Engliſhman*. In 1673 he was at the ſiege of Maeſtricht, where he gained ſuch applauſe, that the king of France made him a public acknowledgment of his ſervice; and the duke of Monmouth, who had the direction of the attack, told king Charles II. that he owed his life to Mr Churchill's bravery. In 1681, he married Sarah daughter and co-heireſs (with her ſiſter the counteſs of Tyrconnel) of Richard Jenning, Eſq; of Sandrich, in Hertfordſhire. The duke of York recommended him in a very particular manner to the king: who, in 1682, created him baron of Eymouth in the county of Berwick in Scotland, and made him colonel of the third troop of guards. A little after king James's acceſſion, he was created baron Churchill of Sandrich in the county of Hertford, and made brigadier-general of his majeſty's army in the weſt; where, when the duke of Monmouth came to ſurpriſe the king's army, while the earl of Feverſham and the majority of the officers were in their beds, he kept the enemy in play till the king's forces had formed themſelves, and thereby ſaved the whole army. When James ſhowed an intention of eſtabliſhing the catholic religion in Britain, lord Churchill, notwithſtanding the great obligations he owed him, thought it his duty to abandon the royal cauſe; but even then did not leave him without acquainting him by letter with the reaſon of his ſo doing. Lord Churchill was graciouſly received by the prince of Orange; and was by him employed firſt to re-aſſemble the troop of guards at London, and afterwards to reduce ſome lately raiſed regiments, and to new-model the army; for which purpoſe he was inveſted with the rank and title of lieutenant-general. In 1689, he was ſworn one of the privy council, and one of the gentlemen of the king's bed-chamber; and on the 9th of April following, was raiſed to the dignity of earl of Marlborough in the county of Wilts. He aſſiſted at the coronation of their majeſties; and was ſoon after made commander in chief of the Engliſh forces ſent over to Holland; and here he firſt laid the foundation of that fame which was afterwards ſpread over all Europe. In 1690, he was made general of the forces ſent to Ireland: where he made the ſtrong garriſons of Cork and Kinſale priſoners of war. The year following, king William ſhowed the good opinion he had of his conduct, by ſending him to Flanders to put all things in readineſs, and to draw the army together againſt his arrival. In 1692, he was diſmiſſed from all his employments, and, not long after, was with ſome other peers committed to the tower on an accuſation of high treaſon; which, however, was afterwards found to be a falſe and malicious report, the authors of which were puniſhed. Marlborough was ſoon reſtored to favour, and in 1698 was appointed governor to the earl of Glouceſter; with this extraordinary compliment from king William, "My lord, make him but what you are, and my nephew will be all I wiſh to ſee him." The ſame day he was again ſworn one of the privy council; and in July following was declared one of the lord juſtices of England, for the adminiſtration of the government, in which great truſt he was three times ſucceſſively in the king's abſence. In 1701 he was appointed general of the foot, commander in chief of the Engliſh forces, and ambaſſador extraordinary and plenipotentiary at the Hague. Upon the acceſſion of queen Anne to the throne, he was elected into the order of the garter, declared captain general of all her majeſty's forces, and ſent ambaſſador extraordinary and plenipotentiary to Holland. After ſeveral conferences about a war, he put himſelf at the head of the army, where all the other generals had orders to obey him. His exploits in the field have been taken notice of under the article Britain, n° 349—370: we ſhall therefore only take notice in this place, of the rewards and honours conferred upon him for theſe exploits. After this firſt campaign he was created marquis of Blandford and duke of Marlborough, with a penſion of L. 5000 out of the poſt-office, to devolve for ever upon thoſe enjoying the title of Duke of Marlborough. In 1703, he met Charles III. late emperor, going to Spain, who preſented him with a ſword ſet with diamonds. In 1704, having forced the enemy's lines at Schellenberg, he received a letter of thanks from the emperor Leopold, written with his own hand; an honour ſeldom done to any but ſovereign princes. After the battle of Blenheim, he received congratulatory letters from moſt of the potentates in Europe, particularly from the States General, and from the emperor, who deſired him to accept of the dignity of a prince of the empire, which with the queen's leave was conferred upon him by the title of *Prince of Mildenheim in the province of Swabia.* After the campaign was ended, he viſited the court of Pruſſia, where he laid ſuch ſchemes as ſuſpended the diſputes with the Dutch about king William's eſtate; which wiſe conduct cauſed the whole confederacy to acknowledge that he had done the greateſt ſervice poſſible to the common cauſe. Upon his return to England, the queen, to perpetuate his memory, granted the intereſt of the crown in the honour and manor of Woodſtock and hundred of Wotton to him and his heirs for ever. In 1705 he made a tour to Vienna, upon an invitation of the emperor Joſeph; who highly careſſed him, and made him a grant of the lordſhip of Mildenheim. After the campaign of 1708, the ſpeaker of the houſe of commons was ſent to Bruſſels on purpoſe to compliment him; and on his return to England he was again complimented in the houſe of lords by lord chancellor Cowper. All his ſervices, however, and all the honours conferred upon him, were not ſufficient to preſerve him from being diſgraced. After the change of the miniſtry in 1710, his intereſt daily declined; and in 1712, on the firſt day of the new year, he was removed from all his places. Finding all arts uſed to render him obnoxious in his native country, he viſited his principality of Mildenheim, and ſeveral towns in Germany; after which he returned to England, and arrived there on the day of the queen's death. After being welcomed by the nobility and foreign miniſters, Churchill.

he attended on king George I. in his public entry through London, who appointed him captain-general, colonel of the firſt regiment of foot-guards, one of the commiſſioners for the government of Chelſea hoſpital, and maſter-general of the ordnance. Some years before his death, he retired from public buſineſs. He died at Windſor-lodge in 1722, aged 73; leaving behind him a very numerous poſterity, allied to the nobleſt and greateſt families in the three kingdoms. Upon his demiſe all parties united in doing honour or rather juſtice to his merit, and his corpſe was interred the 9th of Auguſt following, with all the ſolemnity due to a perſon who had deſerved ſo highly of his country, in Weſtminſter-abbey. The noble pile near Woodſtock, which bears the name of Blenheim-houſe, may be juſtly ſtyled his monument; but without pretending to the gift of prophecy, one may venture to foretel, that his glory will long ſurvive that ſtructure; and that ſo long as Britiſh hiſtories remain, or indeed the hiſtories of Europe, his memory will live and be the boaſt of Britain, which by his labours was raiſed to be the firſt of nations, as during the age in which he lived he was deſervedly eſteemed the firſt of men. If he had foibles, as theſe are inſeparable from human nature, they were ſo hidden by the glare of his virtues as to be ſcarcely perceived or were willingly forgotten. A certain paraſite, who thought to pleaſe Lord Bolingbroke by ridiculing the avarice of the Duke, was ſtopt ſhort by his Lordſhip; who ſaid, "He was ſo very great a man, that I forget he had that vice."

Out of a variety of anecdotes and teſtimonies concerning this illuſtrious perſonage, collected in the new edition of the *Biographia Britannica*, the following ſelection may ſerve to illuſtrate more particularly his diſpoſition and manners.

One of the firſt things which he did, when very young, was to purchaſe a box to put his money in: an indication this of the economical, not to ſay avaricious, temper that accompanied him through life. Dr Joſeph Warton relates, that, on the evening of an important battle, the duke was heard to chide his ſervant for having been ſo extravagant as to light four candles in his tent when Prince Eugene came to confer with him. Mr Tyers, on the other hand, mentioned a circumſtance which, if well founded, redounds to his grace's generoſity, though in a different reſpect it is much to his diſcredit: It is, that during the rebellion 1715 he ſent L 10,000 to the earl of Mar. We conſider the ſtory as only a traditional report, which has not in itſelf any great degree of probability; and therefore we are by no means convinced of its truth. The late Mr Richardſon junior, the painter, hath recorded a pleaſing inſtance of the duke's calmneſs of diſpoſition; for which, indeed, he was always remarkable. "The duke of Marlborough (ſays the writer), riding out once with Commiſſary Marriot, near the commiſſary's houſe in the country, it began to rain, and the duke called for his cloak; Marriot having his put on by his ſervant immediately. The duke's ſervant not bringing the cloak, he called for it again; but the man was ſtill puzzling about the ſtraps and buckles. At laſt, it raining now very hard, the duke called again, and aſked him, 'what he was about that he did not bring his cloak?' 'You muſt ſtay (grumbles the fellow), if it rains cats and dogs, till I can get at it.' The duke only turned to Marriot, and ſaid, 'I would not be of that fellow's temper.'" The duke of Marlborough (adds Mr Richardſon) did by nature and conſtitution, what Seneca judged by philoſophy ought to be done. *Quid eſt quare ego ſervi mei hilarius reſponſum, et contumaciorem vultum, flagellis et compedibus expiem?*

Dr Swift, in one of his letters to Stella, relates the following particulars concerning the duke of Marlborough. "I was early this morning with ſecretary St John, and gave him a memorial to get the queen's letter for the firſt-fruits, who has promiſed to do it in a very few days. He told me 'he had been with the duke of Marlborough, who was lamenting his former wrong ſteps in joining with the Whigs, and ſaid he was worn out with age, fatigue, and misfortunes.' I ſwear it pitied me; and I really think they will not do well in too much mortifying that man, although indeed it is his own fault. He is covetous as hell, and ambitious as the prince of it: he would fain have been general for life, and has broken all endeavours for peace, to keep his greatneſs, and get money. He told the queen 'he was neither covetous nor ambitious.' She ſaid, 'if ſhe could have conveniently turned about, ſhe ſhould have laughed, and could hardly forbear it in his face.' He fell in with all the abominable meaſures of the late miniſtry, becauſe they gratified him for their own deſigns. Yet he has been a ſucceſsful general, and I hope he will continue his command."

Various characters have been drawn of the duke of Marlborough; moſt of which we ſhall omit, as either already ſufficiently known, or as not meriting particular notice. That which is given of him by Dr Swift, in his "Hiſtory of the four laſt years of the queen," has all the malignity and meanneſs of a party pamphlet. It is even ſo fooliſh as to inſinuate, that the duke's military accompliſhments were problematical, and that he was deſtitute of perſonal courage. Mr Macpherſon's character of his grace is very elaborately compoſed, and diſplays no ſmall degree of ability and penetration; though it is not, perhaps, entirely free from prejudice. The hiſtorian conſiders it as a fact, that lord Churchill, at the time of the Revolution, had a deſign of placing his unfortunate maſter king James II. a priſoner in the hands of his rival the prince of Orange. But this ſtory muſt be regarded as wholly unworthy of credit. It is founded upon ſuggeſtions and informations ſo groundleſs, and even ridiculous, that it cannot deſerve a formal refutation. On the other hand, Mr Macpherſon has done juſtice to the duke of Marlborough's proſecution of the war in Flanders, and hath ſhown that he conducted it upon the principles of ſound wiſdom and good policy.

There are two teſtimonies to the honour of the duke's memory, by two celebrated noble writers, which cannot be paſſed over. One is by lord Bolingbroke, in his letters on the Study and Uſe of Hiſtory. Speaking of the conſternation raiſed among the allies of the grand confederacy by the death of king William, and of the joy which that event gave to the French, his lordſhip obſerves, that "a ſhort time ſhowed how vain the fears of ſome and the hopes of others were. By his death, the duke of Marlborough was raiſed to the head of the army, and indeed of the confederacy: where he, a new, a private man, a ſubject, acquired, by merit and by management, a more decided influence than high birth, confirmed authority, and even the crown of Great Britain, had given to king William. Not only all the parts of that vaſt machine, the grand alliance, were kept more compact and entire, but a more rapid and vigorous motion was given to the whole: and, inſtead of languiſhing out diſaſtrous campaigns, we ſaw every ſcene of the war full of action. All thoſe wherein he appeared, and many of thoſe wherein he was not then an actor, but abbettor however of their action, were crowned with the moſt triumphant ſucceſs. I take, with pleaſure, this opportunity in doing juſtice to that great man, whoſe faults I knew, whoſe virtues I admired; and whoſe memory, as the greateſt general, and as the greateſt miniſter, that our country, or perhaps any other, has produced, I honour."

The other teſtimony to the duke's accompliſhments is by the earl of Cheſterfield, in his Letters to his Son, "Of all the men (ſays his lordſhip) that ever I knew in my life (and I knew him extremely well), the late duke of Marlborough poſſeſſed the graces in the higheſt degree, not to ſay engroſſed them: and indeed he got the moſt by them; for I will venture (contrary to the cuſtom of profound hiſtorians, who always aſſign deep cauſes for great events) to aſcribe the better half of the duke of Marlborough's greatneſs and riches to thoſe graces. He was eminently illiterate: wrote bad Engliſh, and ſpelled it ſtill worſe. He had no ſhare of what is commonly called *parts*; that is, he had no brightneſs, nothing ſhining in his genius. He had, moſt undoubtedly, an excellent good plain underſtanding, with ſound judgment. But theſe alone would probably have raiſed him but ſomething higher than they found him; which was page to king James II.'s queen. There the graces protected and promoted him: for while he was an enſign of the guards, the ducheſs of Cleveland, then favourite miſtreſs to king Charles II. ſtruck by thoſe very graces, gave him L.5000; with which he immediately bought an annuity for his life of L.500 a-year, of my grandfather Halifax; which was the foundation of his ſubſequent fortune. His figure was beautiful; but his manner was irreſiſtable, by either man or woman. It was by this engaging graceful manner that he was enabled, during all his war, to connect the various jarring powers of the grand alliance, and to carry them on to the main object of the war, notwithſtanding their private and ſeparate views, jealouſies, and wrongheadedneſſes. Whatever court he went to (and he was often obliged to go himſelf to ſome teſty and refractory ones), he as conſtantly prevailed, and brought them into his meaſures. The penſionary Heinſius, a venerable old miniſter, grown grey in buſineſs, and who had governed the republic of the United Provinces for more than 40 years, was abſolutely governed by the duke of Marlborough, as that republic feels to this day. He was always cool, and nobody ever obſerved the leaſt variation in his countenance: he could refuſe more gracefully than other people could grant; and thoſe who went away from him the moſt diſſatisfied as to the ſubſtance of their buſineſs, were yet perſonally charmed with him, and in ſome degree comforted by his manner. With all his gentleneſs and gracefulneſs, no man living was more conſcious of his ſituation, nor maintained his dignity better."

A peruſal of the above paſſage will convince us of the frivolous turn of the earl of Cheſterfield's mind. His lordſhip, in his zeal to exalt the duke of Marlborough's external accompliſhments, either forgets or depreciates the far greater talents of which he was poſſeſſed. There is an obſervation upon the ſubject in the Britiſh Biography, with which we entirely concur. "That the duke of Marlborough (ſays the writer) was eminently diſtinguiſhed by the gracefulneſs of his manners, cannot be queſtioned: but the earl of Cheſterfield appears to have attributed too much to their influence, when he aſcribes—the better half of the duke of Marlborough's greatneſs and riches to thoſe graces. That the uncommon gracefulneſs of his manners facilitated his advancement, and contributed to the ſucceſs of his negociations, may readily be admitted; but ſurely it muſt have been to much higher qualities that he owed the eſteem of king William and of prince Eugene, his reputation throughout all Europe, and his many victories and conqueſts. It was not by a polite exterior that he obtained his laurels at Schellenberg, at Oudenarde, at Ramillies, and at Blenheim."

How much the duke of Marlborough has been celebrated by our poets, is well known by Addiſon's "Campaign," and Philips "Blenheim." Mr Addiſon, in his Roſamond, has properly aſſumed another and voluntary occaſion of paying a fine compliment to his grace's military expoits, and the glory by which they would be followed. Upon the duke's removal from his places, an ode was inſcribed to him by Mr Somerville, animated with all the zeal of whiggiſh enthuſiaſm, and containing ſome paſſages that are truly poetical. Another ode, not much inferior in ſpirit, was addreſſed to his grace, on occaſion of his embarking for Oſtend in the year 1712.

The duke of Marlborough's Scots title of Baron Eymouth, being to heirs-male, died with himſelf; but his Engliſh title going to his daughters and their heirs-male went into the Spencer family, who retain their own ſurname of Spencer.

CHURCHILL (Charles), a celebrated ſatiriſt, the ſon of Mr Charles Churchill curate and lecturer of St John's, Weſtminſter, was educated at Weſtminſter ſchool, and received ſome applauſe for his abilities from his tutors in that famous ſeminary. His capacity, however, was greater than his application, ſo that he acquired the character of a boy that could do good if he would. As the ſlighteſt accounts of perſons ſo noted are agreeable, it may not be amiſs to obſerve, that having one day got an exerciſe to make, and from idleneſs or inattention having failed to bring it at the time appointed, his maſter thought proper to chaſtiſe him with ſome ſeverity, and even reproached his ſtupidity; what the fear of ſtripes could not effect, the fear of ſhame ſoon produced, and he brought his exerciſe the next day, finiſhed in ſuch a manner, that he received the public thanks of all the maſters. Still, however, his progreſs in the learned languages was but ſlow; nor is it to be wondered at, if we conſider how difficult it was for a ſtrong imagination, ſuch as he was poſſeſſed of, to conform and walk tamely forward in the trammels of a ſchool education: minds

Churchill.

like his are ever ſtarting aſide after new purſuits; deſirous of embracing a multiplicity of amuſing objects; eager to come at the end, without the painful inveſtigation of the means. In ſhort, for want of proper ſkill in theſe languages, he was rejected from Oxford, whither his father had ſent him; and probably this might have given occaſion to the frequent invectives we find in his works againſt that moſt reſpectable univerſity. Upon his return from thence, he again applied to his ſtudies in Weſtminſter ſchool, where, at 17 years of age, he contracted an intimacy with a lady, to whom he was married, and their mutual regard for each other continued for ſeveral years. At the uſual age of going into orders, Mr Churchill was ordained by the late biſhop of London, and obtained a ſmall curacy in Wales of L.30 a-year. Thither he carried his wife: they took a ſmall houſe; and he paſſed through the duties of his ſtation with aſſiduity and cheerfulneſs. Happy had it been for him had he continued there to enjoy the fruits of piety, peace, and ſimplicity of manners. He was beloved and eſteemed by his pariſhioners; and though his ſermons were rather above the level of his audience, they were commended and followed. But endeavouring to advance his fortune, by keeping a cyder cellar, it involved him in difficulties which obliged him to leave Wales and come to London. His father dying ſoon after, he ſtepped into the church in which he had officiated; and, in order to improve his income, which ſcarcely produced L.100 a year, he taught young ladies to read and write Engliſh at a boarding ſchool, kept by Mrs Dennis, where he behaved with that decency and decorum which became his profeſſion. His method of living, however, bearing no proportion to his income, he contracted ſeveral debts in the city; which being unable to pay, a jail, the terror of indigent genius, ſeemed ready to complete his misfortunes: but from this ſtate of wretchedneſs he was relieved by the benevolence of Mr Lloyd, father to the poet of that name. Mean while, Mr Lloyd, the ſon, wrote a poetical epiſtle called the *Actor*; which being read and approved by the public, gave the author a diſtinguiſhed place among the writers of his age. This induced Mr Churchill to write the *Roſciad*. It firſt came out without the author's name; but the juſtneſs of the remarks, and the ſeverity of the ſatire, ſoon excited public curioſity. Though he never diſowned his having written this piece, and even openly gloried in it; yet the public, unwilling to give ſo much merit to one alone, aſcribed it to a combination of wits: nor were Meſſrs Lloyd, Thornton, or Colman, left unnamed upon this occaſion. This miſplaced praiſe ſoon induced Mr Churchill to throw off the maſk, and the ſecond edition appeared with his name at full length. As the Roſciad was the firſt of this poet's performances, ſo many are of opinion that it is the beſt. In it we find a very cloſe and minute diſcuſſion of the particular merit of each performer; their defects pointed out with candour, and their merits praiſed without adulation. This poem, however, ſeems to be one of thoſe few works which are injured by ſucceeding editions: when he became popular, his judgment, began to grow drunk with applauſe; and we find, in the latter editions, men blamed whoſe merit is inconteſtable, and others praiſed that were at that time in no degree of eſteem with the judicious. His next performance was his *Apology to the Critical Reviewers*. This work is not without its peculiar merit; and as it was written againſt a ſet of critics whom the world was willing enough to blame, the public read it with their uſual indulgence. In this performance he ſhowed a particular happineſs of throwing his thoughts, if we may ſo expreſs it, into poetical paragraphs; ſo that the ſentence ſwells to the break or concluſion, as we find in proſe.

Churchill, Churching.

But while his writings amuſed the town, his actions diſguſted it. He now quitted his wife, with whom he had cohabited many years; and reſigning his gown and all clerical functions, commenced a complete *man of the town*, got drunk, frequented ſtews; and, giddy with falſe praiſe, thought his talents a ſufficient atonement for all his follies. In ſome meaſure to palliate the abſurdities of his conduct, he now undertook a poem called *Night*, written upon a general ſubject indeed, but upon falſe principles; namely, that whatever our follies are, we ſhould never attempt to conceal them. This, and Mr Churchill's other poems, being ſhown to Dr Johnſon, and his opinion being aſked, he allowed them but little merit; which being told to the author, he reſolved to requite this private opinion with a public one. In his next poem, therefore, of the *Ghoſt*, he has drawn this gentleman under the character of Pompoſo; and thoſe who diſliked Mr Johnſon allowed it to have merit. Mr Johnſon's only reply to Churchill's abuſe was, "that he thought him a ſhallow fellow in the beginning, and could ſay nothing worſe of him ſtill." The poems of Night and the Ghoſt had not the rapid ſale the author expected; but his *Prophecy of Famine* ſoon made ample amends for the late paroxyſm in his fame. In this piece, written in the ſpirit of the famous North Briton, he exerted his virulent pen againſt the whole Scotch nation; adopting the prejudices of the mob, and dignifying ſcurrility by the aid of a poetic imagination. It had a rapid and extenſive ſale, as propheſied by Mr Wilkes; who ſaid, before its publication, that he was ſure it muſt take, as it was at once perſonal, poetical, and political. After its appearance, it was even aſſerted by his admirers, that Mr Churchill was a better Poet than Pope. This exaggerated adulation, as it had before corrupted his morals, began now to impair his mind: ſeveral ſucceeding pieces were publiſhed, which, being written without effort, are read without pleaſure. His *Gotham*, *Independence*, *The Times*, ſeem merely to have been written by a man who deſired to avail himſelf of the avidity of the public curioſity in his favour, and are rather aimed at the pockets than the hearts of his readers.—Mr Churchill died in 1764, of a miliary fever, with which he was ſeized at Boulogne in France, whither he had gone on a viſit to Mr Wilkes. After his death his poems were collected and printed together in two volumes 8vo.

CHURCHING OF WOMEN AFTER CHILD-BIRTH, took its riſe from the Jewiſh rite of purification. In the Greek church it was limited to the fortieth day after delivery: but in the weſtern parts of Europe no certain time is obſerved. There is an office in the liturgy for this purpoſe.

CHURCHYARD, a piece of ground adjoining to a church, ſet apart for interment or burial of the dead. —In the church of Rome they are bleſſed or conſecrated with great ſolemnity. If a churchyard, which has been thus conſecrated, ſhall afterwards be polluted by any indecent action, or profaned by the burial of an infidel, an heretic, an excommunicated or unbaptized perſon, it muſt be *reconciled;* and the ceremony of the reconciliation is performed with the ſame ſolemnity as that of the bleſſing or conſecration.

CHURCHYARD (Thomas), a poet who flouriſhed in the reigns of Henry VIII. Edward VI. queen Mary and queen Elizabeth, was born at Shrewſbury; and inherited a fortune, which he ſoon exhauſted in a fruitleſs attendance on the court, by which he only gained the favour of being retained a domeſtic, in the family of lord Surrey; when, by his lordſhip's encouragement, he commenced poet. Upon his patron's death, he betook himſelf to arms; was in many engagements; was frequently wounded, and was twice made priſoner. He publiſhed 12 pieces, which he afterwards printed together in one volume, under the title of *Churchyard's Chips;* and alſo the tragedy of Thomas Moubray duke of Norfolk. He died in 1570.

CHURLE, CEORLE, or CARL, in the Saxon times, ſignified a tenant at will, who held of the thanes on condition of rent and ſervice. They were of two ſorts: one rented the eſtate like our farmers; the other tilled and manured the demeſnes, and were called ploughmen. See CEORLE.

CHURNING, in country affairs, the operation of making butter by agitating milk in a well known veſſel called a churn. For accelerating this operation, a correſpondent in the Bath Society Papers recommends a little diſtilled vinegar to be poured into the churn; and the butter will be produced in an hour afterwards. He acknowledges, however, that his experiments have not as yet aſcertained the exact quantity of the acid which is neceſſary to the proper effect, nor the preciſe time of its being mixed with the cream. But he apprehends a table ſpoonful or two to a gallon of cream will be ſufficient; nor would he recommend it to be applied till the cream has undergone ſome conſiderable agitation. His firſt trial was after the churning had been going forward half a day: whether he obſerved the ſame rule afterwards, he does not ſay; but all his trials proved ſucceſsful, the butter being uniformly obtained in about an hour after the mixture.

CHUS, or *Chuſch,* (Bible.) It is a tradition of an ancient ſtanding, that the *Chus* of the Scriptures denotes *Ethiopia,* and *Chuſchi* an *Ethiopian:* the Septuagint and Vulgate conſtantly tranſlate it ſo; and in this they are followed by moſt interpreters, and by Joſephus and Jerome. And yet what Bochart urges to the contrary is of no inconſiderable weight, from Ezekiel xxix. 10. in which the two oppoſite extremes of Egypt are deſigned; and therefore *Chus,* which is oppoſite to Syene, muſt be Arabia: but this is more ſtrongly pointed out by Xenophon, by whom Ethiopia is ſaid to be the ſouth boundary of Cyrus's empire; and Herodotus diſtinguiſhes between the Ethiopians of Aſia and Africa, conjoining the former with the Arabians.

CHYLE, in the animal economy, a milky fluid ſecreted from the aliments by means of digeſtion. See ANATOMY, p. 734, 735.

CHYLIFICATION, the formation of the chyle, or the act whereby the food is changed into chyle.

The chyle has by ſome authors been thought to have a great reſemblance in its nature and chemical analyſis to milk. The ſubject, however, hath as yet been but little inquired into. See the article MILK.

CHYME, or CHYMUS, in the common ſignification of the word, denotes every kind of humour which is incraſſated by concoction; under which notion it comprehends all the humours fit or unfit for preſerving and nouriſhing the body, whether good or bad. It frequently imports the fineſt part of the chyle, when ſeparated from the fæces, and contained in the lacteal and thoracic duct.

CHYMISTRY. See CHEMISTRY.

CHYMOLOGI, an appellation given to ſuch naturaliſts as have employed their time in inveſtigating the properties of plants from their taſte and ſmell.

CHYMOSIS, in medicine, the act of making or preparing chyme. The word comes from χυμος, *ſuccus,* of χυω, *fundo,* "I melt." Chymoſis, according to ſome, is the ſecond of the concoctions made in the body; being a repeated preparation of the moſt impure and groſs parts of the chyle, which being rejected by the lacteals, is imbibed by the meſeraics, and thence carried to the liver, to be there elaborated, purified, and ſubtilized afreſh. It is of this, according to Rogers, that the animal ſpirits are formed.

CHYMOSIS is alſo a diſtortion of the eye-lids, ariſing from an inflammation; alſo an inflammation of the tunica cornea in the eye.

CHYTLA, in antiquity, a liquor made of wine and oil, and ſometimes uſed in divination.

CHYTRI, among the Athenians, a feſtival in honour of Bacchus and Mercury, kept on the 13th of the month Antheſterion.

CHYTRIUM (anc. geog.) a place in Ionia, in which formerly ſtood Clazomene; the Clazomenians through fear of the Perſians, removing from the continent to an adjacent iſland (Pauſanias). Alexander reduced the iſland, by a mole or cauſeway, to a peninſula.

CHYTRUS (anc. geog.), an inland town of Cyprus, to the north of Citium: famous for its excellent honey.

CIANUS SINUS, (anc. geog.), a bay of Bithynia, named from the town and river Cius.

CIBALÆ, or CIBALIS, (anc. geog.), a town of Pannonia Inferior, on an eminence, near the lake Hiulka, to the north-weſt of Sirmium; the country of the emperor Gratian, where he was brought up to rope-making: a place rendered famous for the ſurpriſal and defeat of Licinius by Conſtantine.

CIBBER (Colley), a celebrated comedian, dramatic writer, and poet laureat to the king, was born at London in 1671. His father Caius Gabriel Cibber, was a native of Holſtein, and a ſkilful ſtatuary, who executed the baſſo relievo on the pedeſtal of the monument, and the two admired figures of lunatics over the piers of the gate to Bethlem Hoſpital in Moorfields. Colley, who derived his Chriſtian name from the ſurname of his mother's family, was intended for the church, but betook himſelf to the ſtage, for which he conceived an early inclination; and he was ſome time before he acquired any degree of notice, or even a competent ſalary. His firſt eſſay in writing, was the comedy of *Love's laſt Shift*, acted in 1695, which met with ſucceſs: as did his own performance of the character of the fop in it. From that time, as he ſays himſelf, "My muſe and my ſpouſe were ſo equally prolific, that the one was ſeldom the mother of a child, but in the ſame year the other made me the father of a play. I think we had a dozen of each ſort between us; of both which kinds ſome died in their infancy, and near an equal number of each were alive when we quitted the theatre." The *Careleſs Huſband*, acted in 1704, met with great applauſe, and is reckoned his beſt play; but none was of more importance to him than the *Non-juror*, acted in 1718, and levelled againſt the Jacobites. This laid the foundation of the miſunderſtanding betweeen him and Mr Pope, raiſed him to be the hero of the Dunciad, and made him poet laureat in 1730. He then quitted the ſtage, except a few occaſional performances; and died in 1757. Cibber neither ſucceeded in acting nor in writing tragedy; and his odes were not thought to partake of the genius or ſpirit he ſhowed in his comedies.

His ſon *Theophilus*, alſo a comic actor after him, was born during a great ſtorm in 1703; and after paſſing a life of extravagance, diſtreſs, and perplexity, periſhed in another ſtorm in 1758, in the paſſage between Dublin and England. Theophilus married the ſiſter of Thomas Auguſtin Arne, the famous muſical compoſer; who became a celebrated tragic actreſs, and whoſe honour was ſacrificed to her huſband's extravagance.

CIBDELOPLACIA, in natural hiſtory; a genus of ſpars debaſed by a very large admixture of earth; they are opaque, formed of thin cruſts, covering vegetables and other bodies, by way of incruſtrations.

Of this genus we have the following ſpecies: 1. A greyiſh-white one, with a rough ſurface. 2. A whitiſh brown one: both theſe are friable. 3. A hard, pale-brown kind, which is the oſteocolla of the ſhops. 4. The whitiſh grey kind, with a ſmooth ſurface: this is the unicornu foſſile and ceratites of authors. 5. The whitiſh brown corralloide kind.

CIBDELOSTRACIA, in natural hiſtory, terrene ſpars, deſtitute of all brightneſs and tranſparence, formed into thin plates, and uſually found coating over the ſides of fiſſures, and other cavities of ſtones, with congeries of them of great extent, and of plain or botroyide ſurfaces.

Of theſe there are uſually reckoned ſeven kinds: the firſt is the hard, browniſh-white cibdeloſtracium, found in Germany: the ſecond is the hard, whitiſh cibdeloſtracium, with thin cruſts, and a ſmother ſurface, found alſo in the Harts-foreſts in Germany: the third is the hard, pale-brown cibdeloſtracium, with numerous very thin cruſts, found in ſubterranean caverns in many parts of England as well as Germany: the fourth is the white, light, and friable cibdeloſtracium, found alſo in Germany, but very rarely in any part of England: the fifth is the light, hard, pale-brown cibdeloſtracium, with a ſmooth ſurface, found in almoſt all parts of the world: the ſixth is the whitiſh, friable cruſtaceous cibdeloſtracium, with a rougher ſurface, frequent in Germany and England; and the ſeventh is the browniſh-white friable cibdeloſtracium, with a duſty ſurface, found in ſeveral parts of Ireland, as well as Germany.

CIBORIA, in antiquity, the large huſk of Egyptian beans, which are ſaid to have been ſo large as to ſerve for drinking cups; whence they had their name *ciborium*, ſignifying a cup, in the Egyptian language.

CIBORIUM, in eccleſiaſtical writers, the covering for the altar. This covering is ſupported by four high columns, and forms a kind of tent for the euchariſt, in the Romiſh churches. Some authors call it *turris geſtatoria* and others *pyxis*; but the pyxis is properly the box in which the euchariſt is preſerved.

CIBUS FERIALIS, in antiquity, an entertainment peculiar to a funeral; for which purpoſe, beans, parſley, lettuce, bread, eggs, lentils, and ſalts were in uſe.

Plate CXLIX.

CICADA, the FROG-HOPPHER or FLEA-LOCUST, in zoology, a genus of inſects belonging to the order of hemiptera. The beak is inflected; the antennæ are ſetaceous; the four wings are membranaceous and deflected: and the feet, in moſt of the ſpecies, are of the jumping kind. The ſpecies are fifty-one. The larvæ of ſeveral of this genus evacuate great quantities of a frothy matter upon the branches and leaves of plants, in the midſt of which they conſtantly reſide, probably for ſhelter againſt the ſearch of other animals, to which it would become a prey. Nature has afforded this kind of defence to inſects whoſe naked and ſoft bodies might otherwiſe very eaſily be injured; perhaps alſo the moiſture of this foam may ſerve to ſcreen it from the ſultry beams of the ſun. On removing the foam, you diſcover the larva concealed underneath; but it does not long remain uncovered. It ſoon emits freſh foam, that hides it from the eye of obſervation. It is in the midſt of this foamy ſubſtance the larva goes through its metamorphoſis into a chryſalis and perfect inſect. Other larvæ, whoſe bodies are not ſo ſoft, run over plants without any manner of defence, and eſcape from inſects that might hurt them, by the nimbleneſs of their running, but eſpecially of their leaping.

The chryſalids, and all the larvæ that produce them, differ little from each other, only that the former have the rudiments of wings, a kind of knob at the place where the wings will afterwards be in the perfect inſect. As to other reſpects, the chryſalids walk, leap, and run over plants and trees; as do the larva and the frog hopper, which they are to produce. At length they through off their teguments of chryſalids, ſlip their laſt ſlough, and then the inſect appears in its utmoſt ſtate of perfection. The male alone is then endowed with the faculty of ſinging, which it exerciſes not with its throat, but with an organ ſituated under the abdomen. Behind the legs of the male are obſerved two valvulæ, which, raiſed up, diſcover ſeveral cavities, ſeparated by various membranes. The middle contains a ſcaly triangle. Two vigorous muſcles give motion to another membrane, which alternately becomes concave and convex. The air agitated by this membrane, is modified within the other cavities; and by the help of this ſonorous inſtrument, he amorouſly ſolicits his female. By pulling the muſcles of a frog-hopper lately dead, it may be made to ſing. This inſect begins its ſong early in the morning, and continues it during the heat of the noon-tide ſun. Its lively and animated muſic is, to the country people, a preſage of a fine ſummer, a plentiful harveſt, and the ſure return of ſpring. The cicadæ have a head almoſt triangular, an oblong body, their wings faſtigiated or in form of a roof, and ſix legs with which they walk and leap pretty briſkly. In the females at the extremity of the abdomen are ſeen two large laminæ, between which is incloſed, as in a ſheath, a ſpine, or lamina, ſomewhat ſerrated, which ſerves them for the purpoſe of depoſiting their eggs, and probably to ſink them into the ſubſtance of thoſe plants which the young larvæ are to feed upon.

Cicada *ſeptemdecim*, or Locuſt of North America, ranks with the cricket and graſs-hopper, as one genus of inſects belonging to the order of hemiptera, and has moſt of the diſtinguiſhing characteriſtics of the graſshopper, though its legs do not appear formed for leaping, as it is obſerved the inſect ſeldom removes without uſing its wings.—The characters of the Cicada, or American locuſt, are theſe: The beak is inflected; the antennæ are ſetaceous; the four wings are membranaceous, and deflected, and have much the appearance of the wings of ſome of the fly kind; the thorax is compreſſed and angulated, and the feet, in moſt of the ſpecies, are of the jumping kind.—A gentleman who obſerved it in Pennſylvania in 1782, gives the following account.

"This remarkable inſect, though but trivial attention has been given to its hiſtory, appears as an extraordinary phenomenon in the works of creation. Its periodical viſits—its long abſence—the numbers which riſe from the earth, where they have, perhaps, undergone various transformations, whilſt they have lain, entombed, for the ſpace of 15, 16, or even 17 years, (for they are not always regular in their viſits) certainly deſerve ſome enquiry.

"We know not the progreſs of the American locuſt, through its ſeveral changes during its long confinement in the earth. I have no doubt but it often alters its appearance, and though theſe changes remain, as yet, amongſt the arcana of nature, yet ſome intereſting obſervations may reſult from a purſuit of the enquiry, as far as their laſt appearance, which was in the year 1782, will admit of.

"Towards the latter end of May, under ſuch trees as had been planted, previous to their former viſit, the ground was perforated; ſo as, in ſome degree to reſemble a honey-comb, and from theſe perforations, iſſued an army of theſe inſects; which, if they had been endued with the voraciouſneſs of the locuſts of the eaſt, muſt have ſpread devaſtation and terror throughout the country they fixed upon for a viſit.—But happily the cicada or locuſt, in this ſtate, is not more injurious than the ſportive ſummer graſs-hopper.

"The appearance of the locuſt, when firſt eſcaping from its earthy manſion, is a large amber-coloured grub-worm, about one inch and an half in length, and about an inch and half in circumference; the feet are more ſtrongly formed than thoſe of the graſshopper, and conſiderably ſhorter;—the inſect ſeldom leaping, as has been before obſerved;—in the outer covering, *or grub-caſe, if the term may be admitted*, near the back of the neck, begins an opening, which continues down the body, nearly half the length of the inſect: through this opening the locuſt protrudes itſelf, and appears, at firſt a white coloured moth, nearly reſembling a ſilkworm, in its moth ſtate, though much larger. The wings in this tender ſtate of the inſect are wonderfully folded in cloſe rolls near their baſis, ſo exquiſitely compact, that it required ſeveral careful obſervations, to comprehend the poſſibility of the wings being formed with the inſect, as it really appeared an almoſt inſtantaneous creation, when they were expanded, which was performed by the locuſt ſhaking itſelf with a conſiderable force.

"When the inſect relieves itſelf from the outer covering or grub-worm caſe, the wings are of the hue of rich milk. In this ſtate, the filaments, which add ſtrength to them, are of the ſame white colour, and inſtead of the tranſparency which they afterwards obtain, they are now remarkably opaque; but as ſoon as the moiſture dries from off the wings of the inſect, theſe filaments become more firm, and have a dark brown colour which approaches a black as the locuſt becomes ſtronger.

"The time when they iſſue from the ground, is about an hour or two after ſun-ſet; ſoon after which they begin their exertions to free themſelves from the grub caſe, which the ſtronger ones effect in an hour or two.—They remain on the branches of the trees, which they have attained, (before this laſt metamorphoſis) until morning, when they are of an high amber colour—have acquired their ſtrength, and are able to contend with ſome of their enemies. The weaker ones, and thoſe who do not leave the earth till morning, do not ſo eaſily effect their transformation, and often prove a delicious prey to the larger and even the ſmaller birds.

"While in the grub-worm ſtate, there is a fiſſure in the back of the ſkin, ſufficiently large to admit the locuſt to paſs therefrom, which, notwithſtanding, is not done without great exertions. At the time of their leaving the grub-caſe, for it cannot be, with propriety, termed a chryſalis, life and motion is ſtrong in the inſect, even when it is about aſſuming its new form. And when we conſider that every particular limb, every part of the body however delicately and tenderly formed,—and really ſome of them, at this time, are almoſt inconceivably thin and tender—is incloſed in a ſeparate caſe, and that theſe tender parts muſt be neceſſarily extricated from their ſheaths, before the inſect can enjoy uninterrupted freedom, we certainly feel our aſtoniſhment increaſe, in obſerving, that thoſe ſo elegantly formed members eſcape uninjured from even the extremities of their covering.—When this eſcape is effected, the inſect leaves the place where its covering is, and reſts at a very ſhort diſtance from it, where it remains until the moiſture is evaporated from its body. The wings, as well as the inſects, when firſt protruded from the grubcaſe, are very moiſt and tender; though by degrees they dry, and become more firm and rigid. But ſhould any accident prevent the cicada from a free expanſion of its wings, for a conſiderable time after the grub-caſe is forſaken, the poor inſect is doomed to remain either in a ſtate of total or partial debility;—for ſhould it be ſo weak as to be unable to expand its wings thoroughly, while the moiſture and pliancy remain, as ſoon as they become dry and rigid, they are fixed in that particular or total want of expanſion; and in this helpleſs ſtate, the cicada is a certain prey even to the long-applauded induſtrious emmet.

" The locuſt-grub, riſing from the ground, is nearly the colour of the locuſt when it has attained its full perfection, though not altogether as dark; its ſtrength is very great, nearly equalling that of the ſcarabæus carnifex (or the beetle which forms the balls from ordure): But as it is about to leave the caſe, it becomes weaker.

" At the time of their laſt appearance, an apple-tree was approved of for the theatre of my enquiry; and though it muſt have been very ſmall at the time of their former viſit, yet, having carefully collected the grubs which came up under its branches, the firſt evening I numbered 500, which I removed; the ſecond evening 600 more had made their appearance, and the third evening upwards of 400. Several ſtragglers remained, who were neglected, as the numbers were already ſufficiently great to claim my whole attention.

" Two or three days after their aſſuming the moth ſtate, the air reſounded with their notes, which were re-echoed either on the wing, or on the branches of the trees indiſcriminately. Theſe notes, expreſſive as thoſe of the feathered ſongſters, proved a call to courtſhip. The power of ſong, which ſomewhat reſembled the noiſe of a ſtocking-loom, was confined to the male—which it was eaſy to diſcover was produced by inflating air into his body, and expelling it through two ſmall apertures, placed a little below the baſe of his wings;—theſe holes lead from a muſical table, on each ſide of which are five or ſix thin bars, connected by exquiſitely fine membranes; which, during the time of ſong, maintain a continual vibration. Like the graſshopper, the locuſt very ſeldom ſports its ſocial call without a reſponſe from almoſt all the males within hearing; and frequently when the courtſhip has obtained his mate's approbation, an intruder allured by the concert, which is eaſily diſtinguiſhed, challenges the hero to combat, and the fight is often long and deſperate—as the victory always confers an intereſting reward.*

" When geſtation is fully accompliſhed, which is generally two or three days after they have aſſumed the flying ſtate, the female prepares to depoſit her burden; and although her body does not appear greatly diſtended, yet ſhe generally lays about 140 eggs.—The egg is of a white colour, and about a line in length, and one-third of a line in diameter. Nature has wonderfully provided her with an inſtrument in her tail, ſomewhat reſembling a two-edged ſword, which, like the graſshopper, ſhe can ſheath and unſheath at pleaſure: with this ſhe perforates the tender twigs of ſuch trees as will afford a convenient nidus for the eggs, and depoſits them by 14 or 15, under the bark, in the form of the letter V; and ſometimes ſhe pierces thro' a twig one-fourth of an inch thick.—After ſhe has carefully depoſited her eggs in the ſmaller branches, a ſudden blaſt of wind frequently lops the branch ſhe has choſen for their reſidence.

" It is thus that the parent provides for a ſucceſſion of the ſpecies, in which employment ſhe is generally buſied until about the tenth day of her moth ſtate, ſeldom if ever feeding on any thing but the early dew: For, as they fly in ſuch numbers, (and always careleſsly, without a leader, as is uſual with the eaſtern locuſts) were they to feed on plants the damage muſt certainly be obſervable: and as they live in the moth ſtate twelve or thirteen days, it is probable they have a portion of the dew of heaven for their ſuſtenance. Then they dry up as the ſilk-worm moth,—the male becoming ſuperannuated two or three days before the female.

" Having purſued the locuſt thro' its ſeveral moth ſtages, the numerous offspring it has depoſited in the ſlender twigs of trees, have ſtill ſome claim to an inveſtigation.—The eggs are of a cylindrical form, rounded at the ends, and are of ſuch a conſiſtence, that they require a hard preſſure between the fingers to cruſh them. The ſubſtance within, as in moſt other ſmall eggs, is a white, tranſparent, and viſcous fluid. In about the ſpace of fourteen days, from the time of their firſt being left by the parent, the egg produces a whitiſh inſect, ſomewhat larger than the ſilk-worm, when freſh hatched, which leaves the branch where the neſt was, and, dropping on the ground, either enters into the hole through which the old locuſt iſſued, or turns the earth aſide afreſh, and entombs itſelf there, to undergo the metamorphoſis of its anceſtors.

" In digging wells, cellars, &c. in America, inſects of very different appearances have been diſcovered, ſome twenty feet deep, which have been ſuppoſed to be of this ſpecies—others have been diſcovered nearer the ſurface, of which no doubt remains but that they are the grub of the locuſt—and early in the ſpring, previous to their aſſuming the moth ſtate, the ploughſhare often furniſhes the blackbird, which follows the ploughman, with a rich repaſt of them; for which, by his clamours and flutterings, he endeavours to expreſs his obligations. Varieties of this genus appear annually, they are in general much larger than the cicada ſeptemdecim, and of a greyiſh caſt; the dark brown or amber colour which the others have, appearing in theſe mottled with a dirty white."

CICATRICULA, among natural hiſtorians, denotes a ſmall whitiſh ſpeck in the yolk of an egg, ſuppoſed to be the firſt rudiments of the future chick.

CICATRIX, in ſurgery, a little ſeam or elevation of callous fleſh riſing on the ſkin, and remaining there after the healing of a wound or ulcer. It is commonly called a *ſcar*.

CICATRIZANTS, in pharmacy, medicines which aſſiſt nature to form a cicatrix. Such are Armenian bole, powder of tutty, &c.

Cicatrizants are otherwiſe called *eſcharotics*, *epulotics*, *incarnatives*, *agglutinants*, &c.

CICCA, in botany; a genus of the tetrandria order, belonging to the monœcia claſs of plants. The male calyx is tetraphyllous; there is no corolla: the female calyx tryphyllous; no corolla; four ſtyles; the capſule quadricoccous, or four berried.

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* Mas et feminina Cicada in coitu [æquè ac Grylli ſpecies] adeo firmiter uniti, ut ſine corporum mutilatione ſeparari nullo modo poſſint; et in hoc ſtatu per horas multas remanent, donec foecundationis opus perfectum ſit. Per lucos firmiter ſic uniti ſæpe volitant, et complures ſimul in conſpectu apparent.

CICELY, in botany, the Engliſh name of a ſpecies of chærophyllum. See CHÆROPHYLLUM.

CICER, or **CHICK-PEA**, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the *Papilionaceæ*, or 32d order. The calyx is quinquepartite, as long as the corolla, with its four uppermoſt ſegments incumbent on the vexillum: the legumen is rhomboidal, turgid, and diſpermous. There is but one ſpecies, which produces peaſe ſhaped like the common ones, but much ſmaller. They are much cultivated in Spain, where they are natives, being one of the ingredients in their olios; as alſo in France; but are rarely known in Britain.

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